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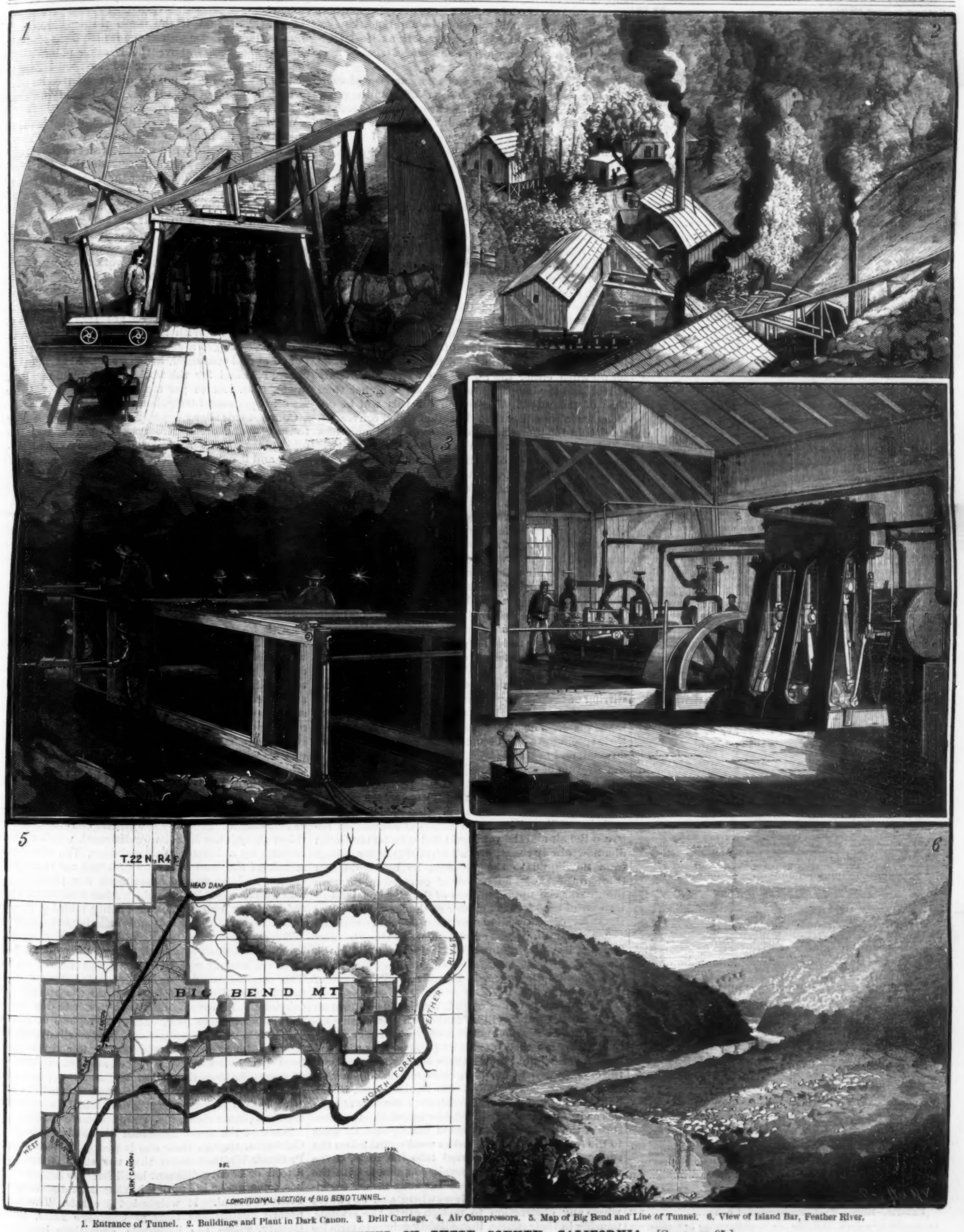

1. Entrance of Tunnel. 2. Buildings and Plant in Dark Canon. 3. Drill Carriage. 4. Air Compressors. 5. Map of Big Bend and Line of Tunnel. 6. View of Island Bar, Feather River.

THE BIG BEND TUNNEL IN BUTTE COUNTY, CALIFORNIA.—[See page 85.]

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NEW YORK, SATURDAY, FEBRUARY 6, 1886.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 527

For the Week Ending February 6, 1886.

Price 10 cents. For sale by all newsdealers.

STOPPAGE OF THE CLEVELAND WATER TUNNEL BY ICE SPICULES.

The system of running tunnels out to some distance under the surface of the water in our Western lakes, to gain a supply of pure water for cities on the shores thereof, has, in the main, proved highly successful. The single defect yet unsurmounted is the liability of these tunnels to become clogged with ice in cold weather, and thus cut off the water supply.

To the citizens of Cleveland, in whose memories the recollection of the great fires of sister cities is yet fresh and vivid, it must have been a starling announcement on the morning of January 14 that the water supply was entirely cut off by ice accumulation in the tunnel between the lake crib and the pumping station; that the principal industries of the city must be suspended, and its valuable property left, at least temporarily, to the mercy of circumstances should fires break out.

There ought never again to be a recurrence of such a danger and inconvenience to any town from the cause named. It can be wholly and cheaply prevented, as we shall proceed to point out; but first let us consider briefly the causes of the stoppage.

These are to be sought in well-ascertained principles of ice formation, under the condition that the application of the cold to the liquid to be frozen is made to the upper surface.

When a mass of still water having a temperature above 4° C., or 39° F., is exposed to a superimposed mass of air colder than the water, two surface actions for the removal of heat from the liquid unite their forces, to wit, convection and radiation.

The latter of these modes of heat change acts constantly, summer and winter, without any dependence upon the temperature of the air, except in so far as temperature affects the amount of water vapor held suspended in air. Air not being a radiating body, its action upon the upper surface of water can only effect heat change by convection, and this action will not be set up when either the air or the water is perfectly at rest, and the temperature of the air is higher than that of the water. The reason for this will be obvious when we reflect that the action called convection consists in the interchange of place of fluid molecules which are hotter with those that are colder; and that the colder molecules of water descend at all temperatures above that known as the temperature of maximum density, while the colder molecules of air descend, when free to move, at all temperatures yet known as naturally or artificially produced. It follows that when the upper surface of a still mass of water is in contact with a mass of superincumbent air, the warmer stratum of the water will be uppermost, and the colder stratum of the air will be that resting upon the water—a condition under which the motion needed for the action of convection is impossible.

But if the air be colder than the water, the lower stratum of air molecules derives heat from the upper stratum of water molecules; the former rises and the latter falls, and the action of convection at once begins.

This action continues (always provided there is no stirring of the mass by exterior forces) till the water reaches 4° C., or 39½° F., when a remarkable change takes place. The water molecules now expand, and their specific gravity becomes less; they now cease to descend, and begin to rise.

A stratum of water, having the temperature of 4° C., now forms at the upper surface of the water mass, and there remains. By contact with the colder air, this stratum quickly reaches the freezing point, and congeals into a film of ice. The action of convection between the air and the yet liquid water under the frozen film now wholly ceases, and all further transfer of heat from the liquid to the air must be by conduction through the ice. The action of convection between the air and the upper surface of the sheet of ice and transfer of heat from the water to the lower surface of the sheet of ice continue so long as any part of the water remains unfrozen; and not until the ice, after freezing, has cooled down to the temperature of the air will the heat transfer wholly cease. Radiation greatly assists the process. This is nature's method of manufacturing ice.

The upper film of ice, when it first begins to form on a still mass of water, will be found, when critically examined, to be a curious network of crystals, very slightly cohering at their angles or points. The slightest motion of the liquid breaks these connections, and sets the crystals free to move in obedience to any current that may be generated in the liquid. Now, if the liquid be kept constantly stirred, each stratum of crystals as it forms will be carried downward, the temperature of the water will be reduced throughout its mass to the freezing point, and just as meal sprinkled on the surface of water can be stirred into the mass, so the continuously forming ice crystals commingle with the liquid portions, and the mass becomes (to use a common phrase) "mushy." Everywhere and anywhere where any obstruction to motion exists, the crystals, pausing in their course, immediately cohere to form ice masses themselves, also obstructive to motion, and at last large, granular, milky-looking masses of ice result. It hardly needs to be added that the conditions of ice formation on the Lakes must sometimes conform to what we have described.

Whenever the temperature of maximum density has been attained at their surfaces, and the action of winds and waves, assisted by a current into the mouths of the tunnels of the water supplies, becomes sufficiently intense to produce the "mushy" condition, the tunnels are sure to become obstructed, either partially or wholly. Strainers at the mouths of the tunnels, no matter how they may be constructed or arranged, cannot meet the difficulty; if fine enough to prevent the passage of the ice spicules, they inevitably become clogged.

It is evident that, if the mean temperature of the water entering the mouth of the tunnel be kept even a fraction of a degree above the freezing point, and if the ice particles be also melted as they enter, or just before they enter, no ice obstruction could even form in any part of the tunnels, these being by their situation protected from freezing.

We will briefly calculate the amount of heat required to effect this for a million of gallons, assuming 10 per cent as the proportion of ice in the water at the instant of inflow, which is probably considerably too high. For simplicity, we will consider the specific gravity of ice to be the same as that of the water, and the weight of a gallon of water to be eight pounds.

We shall then need to heat 900,000 gallons of water one-quarter of one degree, and melt 100,000 gallons of ice.

We shall need for the entire work $900{,}000 \times 8 \div 4 = 1{,}800{,}000$; $100{,}000 \times 142{\cdot}4 \times 8 = 113{,}920{,}000$.

Total (heat units) = 115,720,000.

Dividing this total by 966·5, the heat obtainable from one pound of steam, we get 119,710 pounds of steam required. With a boiler of good type, well housed, we can get a steam product of 10 pounds per pound of coal consumed, hence we have 11,971 pounds of coal required for the work, or, in round numbers, say 5½ tons. At $5 per ton this would cost $27.50, or 2¾ cents per each 1,000 gallons delivered.

Contrast this slight expense with the loss per hour to the city of Cleveland from the stoppage of her manifold industries, the risks entailed upon insured property and insurance writers, and the untold inconvenience and suffering in families.

The steam could be conveyed to and discharged into the water entering the mouth of a tunnel by insulated pipes from boilers located at the crib. The necessity for its use being for only a few days each winter, the steam could be supplied from the boilers of tugboats.

AMERICAN PRECIOUS STONES.

The recent volume on "The Mineral Resources of the United States," published by the Government, contains an interesting paper by Mr. George F. Kunz on the history and production of gem stones in America. For a country so otherwise richly endowed with mineral wealth as the United States, her product of precious stones is surprisingly small. The total value of gems mined in this country during 1884 amounted to but $82,975. Almost two-thirds of this sum was for minerals valuable only as cabinet specimens, and therefore not strictly to be classed under the head of gems. In addition, the value of the gold quartz withheld from reduction for use in jewelry and as specimens is calculated to be $140,000.

Though in point of quantity and value among the most insignificant of the entire list, the diamond, as the stone of all stones, naturally receives the first consideration. Probably the largest one ever found in this country is the Manchester diamond, which was unearthed by a laborer at Manchester, Va., about the middle of the century. The gem was not recognized at first, and by way of experiment was placed in an iron furnace at Richmond. After remaining at a red heat for two hours and twenty minutes, it was found to be unimpaired and brighter than before. When recognized, it was valued at $4,000. It passed through a number of hands, being cut at an expense of $1,500, and at one time $6,000 was loaned on it. The original weight was 23¾ carats. This was reduced by cutting to 11½ carats. As the stone is off-color, and imperfect, it is not worth to-day more than from $300 to $400. The gold regions of North Carolina have produced a number of small diamonds. Among the first discovered was a fine octohedron from Brindletown Creek, valued at $100. A number of stones, improperly classed as diamonds, proved on examination to be quartz pebbles or zircons. Another stone, of fine white color, found in a South Carolina placer claim, has a reputed value of $400.

Some of the finest American diamonds come from California, though their size is generally quite small. Professor Whitney states that the stone is found in fifteen or twenty different localities, the largest that has come under his notice having been discovered at French Corral. It weighed 7¼ carats. The most prolific locality has been at Cherokee Flats, Butte County, where the hydraulic operations have disclosed a number of diamonds of all colors, white, yel-

low, straw, and rose. They are found with zircons, platinum, iridium, and other associates of the diamond. They are also found in connection with itacolumite, that peculiar flexible sandstone which is likewise native to North Carolina. So far as known, $500 is the highest price ever paid for any California diamond in the rough. Large numbers, however, have been sold for from $10 to $50, and not a few have brought as much as $100. Among the sapphire gems, a number of excellent specimens have been found, particularly in North Carolina. Probably one of the finest known specimens of emerald green sapphire was found at Jenks Mine, in Franklin County. It is the transparent part of a corundum crystal, 4 by 2 by 1½ inches. It would probably furnish gems to the amount of 100 carats. Being very rare, its value is over $1,000. Fine specimens of chrysoberyl and spinel have been found in various localities in New England, New York, and the Southern States. The Platte Mountains, in Colorado, have afforded the best crystals of topaz. One of these weighs 125 carats, and is as fine a gem of any kind as America has ever produced. The crystals gathered from this one locality, during a period of fourteen months, have sold for nearly a thousand dollars. Emeralds, beryls, and some of the less commonly known minerals, such as zircon, tourmaline, and staurolite, have been found in small quantities, but have not proved of much importance as gems. In garnets, however, America has produced stones comparable with the best products of Africa and the East. Though smaller than those found in the diamond mines of the Cape of Good Hope, the garnets of the Colorado River plateau are unsurpassed in color and clearness. The Cape garnets retain their dark color by artificial light, but in the American nothing but the clear blood color is visible. As a mineral they are found all over the United States, wher ever the older formations are exposed, but it is only occasionally that they are sufficiently transparent to rank as gems.

It is in the group of silicates that we find the largest value among American gem minerals. In transparent quartz, particularly fine crystals have been found in New York. The purple variety, the well known amethyst, is quite common in New England, one specimen found near Cheshire, Conn., being almost equal in color to the much praised Siberian gems. Several southern localities likewise afford excellent specimens. The most remarkable native amethyst is that recently deposited in the National Museum by Dr. Lucas. It is a turtle-shaped prehistoric cutting, which measures 2¾ inches in length, 2 inches in width, and 1½ inches in thickness. The whole stone is transparent and without a flaw. Smoky quartz has returned the largest revenue of any of the gem stones, amounting, in 1884, to $10,000. The finest specimens are those from Bear Creek, Colorado, where finely developed crystals, from an inch to over four feet in length, have been found. In many of the specimens, included minerals, such as rutile, asbestos, and gothite, add much to their beauty and value. Quartz crystals containing fluid cavities with moving bubbles are of particular interest, and have been found in a number of localities. There are in addition a large number of less valuable stones, whose beauty still attracts admiration. The beautiful green variety of feldspar known as Amazon stone, which has been found in fine crystals at Pike's Peak, is much prized as cabinet specimens. The numerous varieties of silicified wood have afforded as pretty specimens as can be found the world over. Numbers of minerals also, which have but a nominal value in themselves, are made up into attractive articles. Anthracite is carved and turned into a variety of pretty trinkets, of which $2,500 to $3,000 worth are sold annually. Pipestone, from those red pipestone quarries in Minnesota which are so well known to readers of "Hiawatha" as having afforded the material of the famous peace pipe smoked by Gitche-Manitou, the Mighty, is still used for the same purpose, only that the pipes sell for $1 to $20 apiece, according to the carving, and circulate strictly among mortals.

There are many inducements for a systematic search for precious stones. Though we produced but $28,650 worth of gems proper, we imported during the same year diamonds and other precious stones to the amount of over $9,000,000. A more intimate knowledge of American resources will probably, in time, somewhat reduce this undesirable proportion between the native and imported gems.

Historical Electrical Apparatus.

In a lecture delivered before the Franklin Institute, Philadelphia, Mr. C. J. Kintner, chief examiner of the Department of Electricity, in the United States Patent Office, spoke of a number of notable pieces of electrical apparatus in the possession of the office, and of the wonderful increase in the growth of the business of this department during the past few years.

Prior to the year 1881, electrical apparatus was only a sub-department under the general classification of philosophical instruments. In that year, it was made into a separate class. Since then, the number of inventions has multiplied so rapidly that during the past year the electrical department was given nine classes in place of one. The greatest epoch in the history of the art was in 1876. Before that time, there had been but 1,973 patents taken out for electrical inventions. Since then there have been 8,000 new patents. It was in 1833 that the first patent in this department was granted to D. Harrington, a Philadelphian, for an invention meant to cure disease by an application of electricity. Two more patents were granted to the same inventor for similar devices, but these three were the only electrical patents granted before the regular establishment of the Patent Office, in 1836. Among the most famous of the models in the possession of the Government, Mr. Kintner mentioned Morse's telegraph instrument, which, he stated, was, like all that inventor's models, a marvel of good workmanship and performance. Bell's telephone, the Brush electric light, and many other devices not so well known to the general public, make up a list of inventions upon which large industrial operations have been based and to which our present progress is largely attributable.

THE surplus of the Ætna Insurance Company is now over $3,200,000, which is larger than the capital of any other fire insurance company.

NIGHT SKY—JANUARY AND FEBRUARY.

BY RICHARD A. PROCTOR.

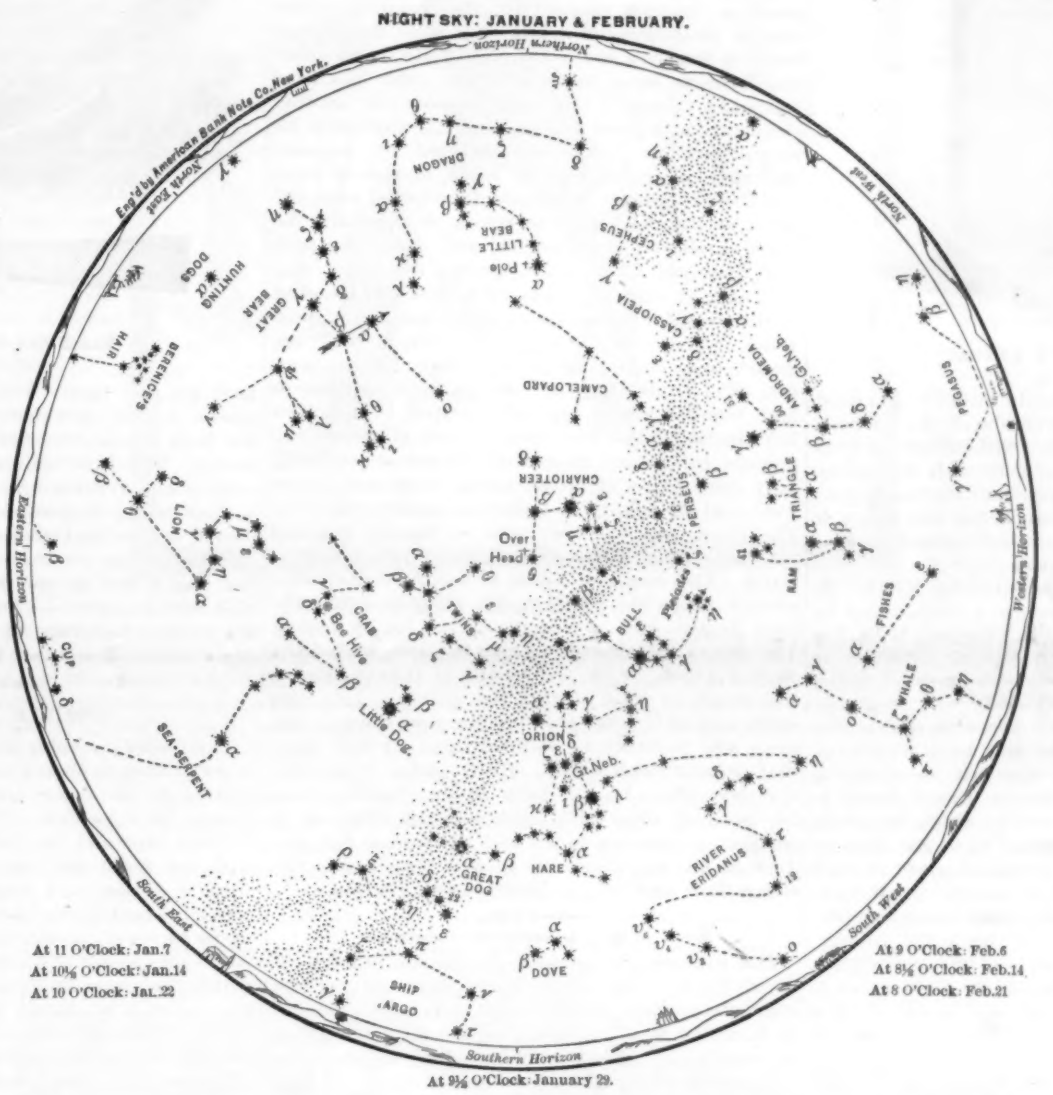
The Great Bear (*Ursa Major*), with its Dipper and Pointers, occupies the northeasterly mid-heaven. A line from the Pole Star (and of the Little Bear, *Ursa Minor*) to the Guardians, β and γ, lies in the position of the minute hand of a clock 18 minutes after an hour. The Camelopard (*Camelopardus*) is above. The Dragon (*Draco*), whose head is below the horizon, curves round the Little Bear to between the Guardians and the Pointers. In the northwest, fairly high up, we find *Cassiopeia*, the Seated Lady, and on her right, lower down, the inconspicuous constellation *Cepheus*. *Andromeda*, the Chained Lady, is on Cassiopeia's left. The Great Nebula will be noticed in the map—it is faintly visible to the naked eye. Above Andromeda is *Perseus*, the Rescuing Knight, and above him the Charioteer (*Auriga*), nearly overhead. On the left of Andromeda is *Aries*, the Ram, the small constellation, the Triangle, lying between them.

Toward the southwest, the Whale (*Cetus*) is beginning to set. The River (*Eridanus*) occupies the lower part of the southwesterly sky, and extends also to the mid-heavens in that direction. The Dove (*Columba*) is nearly due south, and at its best—which is not saying much. Above is the Hare (*Lepus*), on which *Orion* treads. The giant now presents his noblest aspect—prince of all the constellations, as he is. He faces the Bull (*Taurus*), known by the Pleiads and the bright Aldebaran.

Close by the poor Hare, on the left, leaps *Canis Major*, the Greater Dog, with the bright Sirius, which "bickers into green and emerald." The stern of the star ship Argo is nearing the south.

Very high in the southeast we find the Twins (*Gemini*), with the twin stars, Castor and Pollux (α and β); and below them the Little Dog (*Canis Minor*). The Sea Serpent (*Hydra*) is rearing its tall neck above the eastern horizon (by south), as if aiming either for the Little Dog or for the Crab (*Cancer*), now high up in the east, with its pretty Beehive cluster showing well in clear weather. The Lion (*Leo*) is due east, the Sickle (marked by the stars α, η, γ, μ, and ε) being easily recognized.

Queen Berenice's Hair (*Coma Berenices*, not *Berenicis*, as often ignorantly given) is in the northeast. It used to mark the tip of the real Lion's tail, just as the stars of the Crab marked his head. The Hunting Dogs occupy the space between Berenice's Hair and the Great Bear.



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

Cement for Cast Iron.

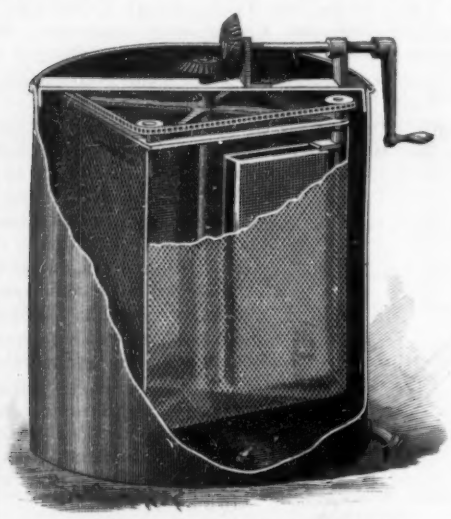
A correspondent of the *English Mechanic* says that he used the following recipe with the greatest success for the cementing of iron railing tops, iron gratings to stoves, etc., and with such effect as to resist the blows of a sledge hammer: Take equal parts of sulphur and white lead, with about a sixth of borax; incorporate the three so as to form one homogeneous mass. When going to apply it, wet it with strong sulphuric acid and place a thin layer of it between the two pieces of iron, which should then be pressed together. In five days it will be perfectly dry, all traces of the cement having vanished, and the iron will have the appearance of having been welded together.

The American Exhibition in London.

The Executive Council of the American Exhibition Company have announced that the time for the opening of the exhibition has been postponed a year, and that May, 1887, has been chosen as a more favorable time. This change has been made because the Colonial and Indian Exhibition will be held next spring in London, and it is naturally thought that the simultaneous occurrence of the two exhibitions would interfere with the success of the American enterprise. Minister Phelps, Consul-General Waller, and other prominent Americans have advised the postponement.

HONEY EXTRACTOR.

In the old style honey extractor the honey is thrown from two combs placed in opposite sides of a wire cloth basket, which is rapidly revolved by means of a simple gearing placed at the top. The extractor here shown is revolved in the same way, but instead of throwing the honey from two combs at a time, it may be made to throw from four, six, or eight. The combs are placed in wire cloth pockets, which are free to swing on round steel rods placed vertically at the corners of the basket. On top of each rod is a small wheel, provided with a series of steel pegs in its face. Passing around these wheels is a steel band formed with holes, which engage with the pegs. By slightly pulling on this band, or by grasping one of the pockets, all of the pockets may be turned simultaneously either to the right or left without reversing the motion of the machine. The combs may thus be reversed without raising them from the machine or touching them with the hands. It will be seen that with this extractor the combs may be easily reversed several times before the honey is wholly removed from both sides—an advantage that will be appreciated by beekeepers.

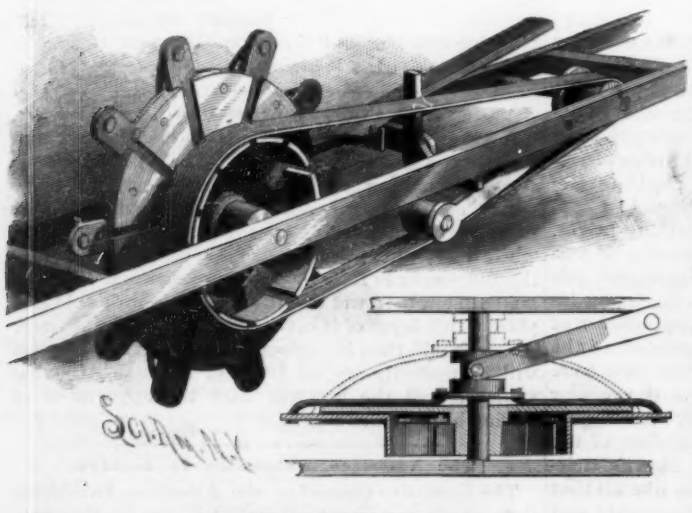


TREADWELL'S HONEY EXTRACTOR.

This invention has been patented by Mr. W. B. Treadwell, and the extractors are manufactured by Messrs. Aspinwall & Treadwell, of 16 Thomas Street, New York city.

EXPANDING PULLEY.

By means of the mechanism herewith shown, the speed of a belt-driven pulley may be increased or diminished without shifting the belt or stopping the machine. In the supporting frame there is mounted a driving shaft, secured to which is a disk having a number of plates riveted to it, and formed with flange-like projections, constituting radial ways between the plates. The face of the driving pulley is made up of a number of circular sections, which project at right angles from arms sliding in the grooves. Rods connect the extending ends of the arms with a collar mounted loosely on the shaft. This collar is formed with an annular groove, and is shifted by a lever pivotally connected to the frame, as shown in the sectional view. It will be seen that, by moving the lever to carry the collar up close to the disk, the rods will act to extend the arms, thereby carrying the circular sections away from the shaft, and consequently increasing the diameter of the driving pulley; moving the collar away from the disk lessens the diameter of the pulley. In order that a proper tension may always be maintained upon the belt, irrespective of the size of the driving pulley, the apparatus is provided with a tightening pulley, carried by a swinging arm. When the main lever is moved to diminish the diameter of the driving pulley, the tightening pulley is depressed by a bell crank lever operated by the main lever, as shown in the perspective view, and the belt is forced downward, so that an equal amount of tension is always maintained upon it. Instead of this method, it will be understood that the driven pulley might also be formed with an expanding peripheral face, that might be made to be adjusted simultaneously with the driving pulley, but in an inversed direction. The main lever is held by a catch in any desired position.



HERMAN'S EXPANDING PULLEY.

This invention has been patented by Mr. John M. Herman, of Mallard, Iowa.

California Cream of Tartar.

Among the various industries and sources of revenue of Los Angeles, California, which are a perfect success so far as they have been well attended to, is the production of argols and the manufacture of cream of tartar from same. A gentleman who has been engaged in the business for some time in Los Angeles has been very successful, although it has been with a great deal of difficulty with his limited means to secure a location adapted to the handling of the wine or producing the argols on a scale that would make it largely a source of profit. He commenced the business some four years ago, and has been compelled to move from one location to another frequently at a great expense and interruption to his enterprise. The argols are obtained by suspending small pieces of rope in casks or vats of wine, like the old process of making dip candles, when the tartar crystals form on the pieces of ropes until the wine is relieved of its acidity and materially aged and improved. When the crystals are taken out, they are put through a refining process and bleached of their reddish brown color, and come out in pure white crystals ready for the mill, where they are ground to an impalpable powder, ready for the market. The crude argols are usually kept for three or four months, when they are shipped to the New York market. The wine from an acre of grapes will produce from thirty to seventy-five pounds of chemically pure cream of tartar, owing, of course, to the yield and the acidity or tartar contained in the wine. The wines from the low, moist, or heavily irrigated vineyards usually contain a greater percentage of tartar. The cream of tartar of Southern California always commands a higher price than that brought from France, and is eagerly sought for by dealers. The use of the wine can be had for from one to three cents a gallon, or the equivalent of the evaporation and waste of wine during the process. Last year seven tons of this valuable product were shipped, and there will probably be shipped three or four times that quantity this season. He is just now building a factory where he will have an abundance of room for handling wines. His furnaces and kettles are in position, as are his tanks and cooperage for conducting his operations on a much larger scale this season than ever before.—*Independent Journal.*

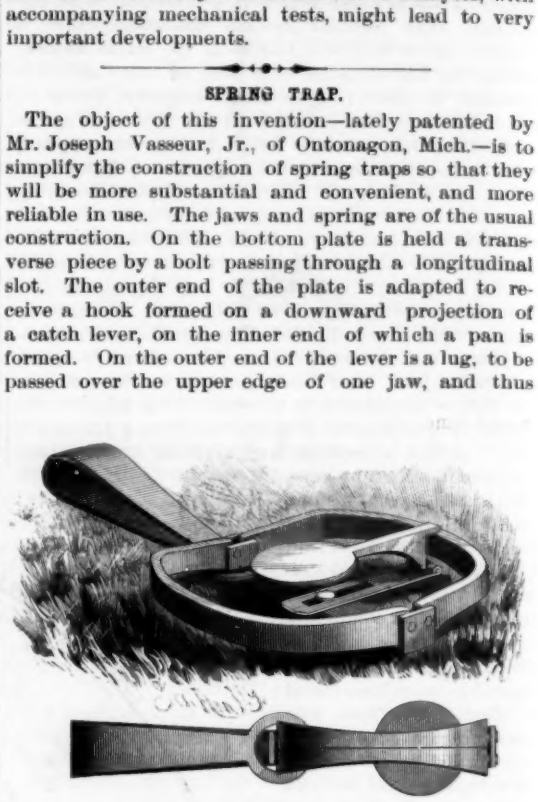
Does Oxygen Deteriorate Castings?

The presence of occluded oxygen and of oxides in metals has long been recognized as the cause of deterioration of quality which appears as flaws in casting or in reduced strains. In silver, oxygen causes sprouting; in copper and nickel, oxides produce red-shortness, while in steel they affect the tensile strength; in lead, patches of oxide lead to more rapid corrosion and pitting. The removal of oxides is generally accomplished by adding more readily oxidized substances, like manganese in steel, phosphorus in copper and bronze, and magnesium in nickel.

Though long recognized as a source of danger, and provided against in the manner indicated, our chemists have not well succeeded in giving us figures to judge of its magnitude or allow of arriving at conclusions concerning the counteracting methods adopted. Special interest, therefore, attaches to a series of data contained in a paper by Professor Ledebur, of Freiburg, who reports, according to the London *Iron Trade Exchange*, that in different grades of steel, ranging from 0·14 to 0·37 per cent of manganese and 0·12 to 0·32 per cent of carbon, he found from 0·12 to 0·03 per cent of oxygen. The former figure, naturally referring to the milder steel, with a comparatively low percentage of manganese, is, nevertheless, surprisingly large. It has been repeatedly suggested, in discussions on the quality of steel in the meetings of technical societies, that oxygen, or rather oxides, play a part in affecting mechanical properties the importance of which we do not appreciate as yet. Since the presence of given quantities of phosphorus, sulphur, copper, and possibly arsenic, has failed in many instances to account for mysterious failures, it is possible that, especially with mild steels, oxygen may be shown to be the bugbear. The subject is one which invites closer study, and the *Iron Trade Exchange* thinks a series of analyses, with accompanying mechanical tests, might lead to very important developments.

SPRING TRAP.

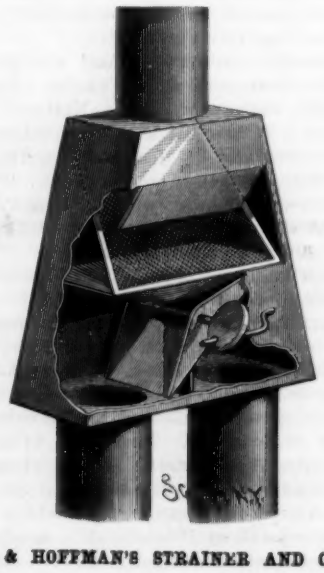
The object of this invention—lately patented by Mr. Joseph Vasseur, Jr., of Ontonagon, Mich.—is to simplify the construction of spring traps so that they will be more substantial and convenient, and more reliable in use. The jaws and spring are of the usual construction. On the bottom plate is held a transverse piece by a bolt passing through a longitudinal slot. The outer end of the plate is adapted to receive a hook formed on a downward projection of a catch lever, on the inner end of which a pan is formed. On the outer end of the lever is a lug, to be passed over the upper edge of one jaw, and thus hold the jaws open. The animal steps upon the pan, presses it down and thereby causes the lug to release the jaws, which are thrown against each other by the spring. When the trap is to spring easily, the cross-piece is moved toward the middle of the bottom plate, so that the lug projects less over the jaw; the trap, of course, can be made to spring with more difficulty by making the lug project farther over the jaw. When the trap is not in use, the cross piece is swung parallel with and over the bottom plate, so that the trap will occupy less space, and can be packed and stored in a smaller place, as shown in the lower figure.



VASSEUR'S SPRING TRAP.

STRAINER AND CUT-OFF.

This device is employed to strain and direct the flow of water from the house-top, the first or dirty portion passing to the sewer, and the next or clean portion passing to the cistern. The casing is provided with an inlet pipe and two outlets, one of which connects with the sewer and the other with the cistern. The strainer consists of a wire gauze mounted diagonally across the path of the inlet pipe and extending from the upper corner of one side to about the middle of the opposite side, a part of the lower portion of which is bent within the casing to form a deflecting plate, by which the water, if it should spread on leaving the pipe, would be thrown back upon the strainer. Just below a horizontal central partition having a central opening is pivotally mounted a deflecting plate, that can be securely held, so as to guide the water either to the sewer or cistern pipe. The first water from the roof is sent into the sewer; the plate is then shifted to send the clean water into the cistern. The strainer intercepts any debris of appreciable size that may come from the roof.



HOUGH & HOFFMAN'S STRAINER AND CUT-OFF.

This invention has been patented by Messrs. W. W. Hough and H. C. Hoffman, of Mound City, Ill.

MACHINE FOR CARDING BUTTONS BY ELECTRICITY.

Machinery is every day taking the place of the workman in the industrial arts; everything is done automatically, even the most complicated operations, which one would suppose could only be accomplished by hand. Inventors now have another source besides mechanics to which they can appeal, namely, electricity, which enables them to solve many problems which, without it, would remain unsolved. We have an example of this in the curious machine represented in our cut, and which makes use of the properties of the electro-magnet. It is designed for stamping shoe buttons in lots of three or four dozen, on cardboard sheets, for commercial uses.

The buttons are placed on an inclined plane, A, shaped like a fan and provided with grooves which at the lower end are large enough to receive only a single button at a time. The inclined plane is kept in state of vibration, causing the buttons to descend; but at the lower end of the grooves they are stopped by a grating, B, mounted on a cross bar. The cardboards destined to receive the buttons are held one behind the other by little hooks on two leather bands, DD, mounted on actuating pulleys like an endless belt. These slip along the table (the front part of which has been broken away to show the construction), and carry with them the cardboards. In this manner these are brought underneath the inclined plane and over the electro-magnet, E, the pole of which, M, is shaped like a comb, with its teeth so arranged that each one of them will be located immediately under a groove through which the button is delivered.

The machine operates in this manner: Power is applied through the grooved pulley shown at the left. By means of cams on the shaft of this pulley the cross bar and the grating, B, are raised at equal intervals to allow a row of buttons to pass through, when they immediately fall again.

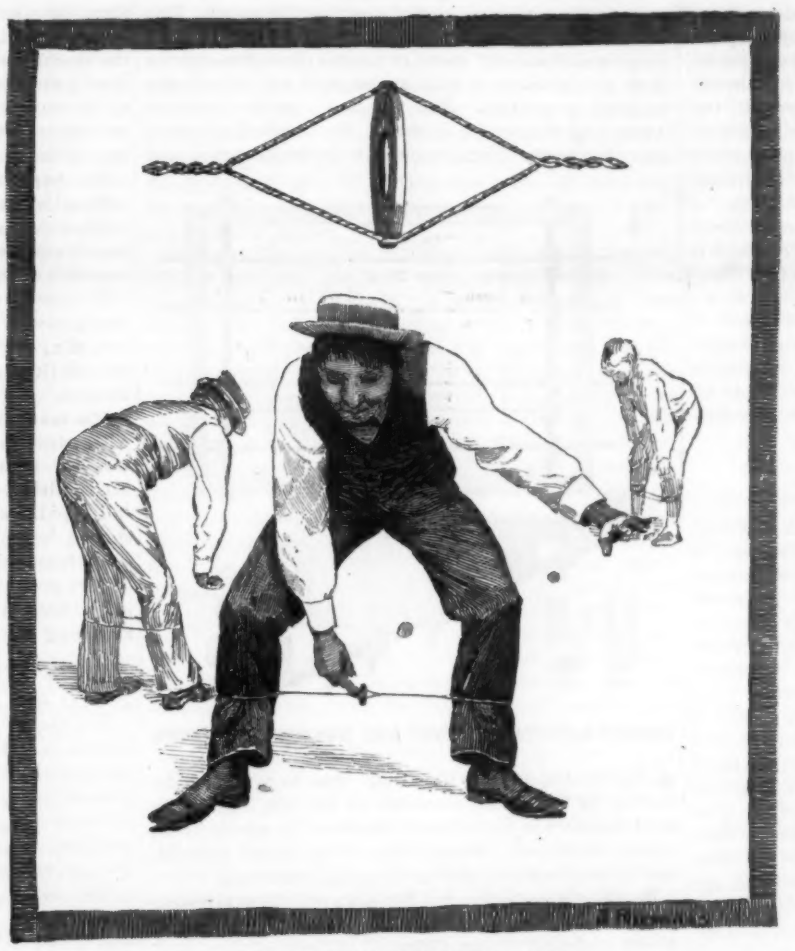
The buttons are received by the cardboard, which passes underneath them, and at that moment a current is passed *through the electro-magnet*, E, each tooth of the pole, M, *attracts* the metal loop of the button which is opposite to it, and holds it in a vertical position with its head raised and with its loop pressing against the cardboard. The cross bar, C, which is actuated by the eccentric, F, under the action of a strong spiral spring, descends at that moment and presses on the heads of the buttons, forcing the loops through the cardboard, where they thus become firmly fixed.

The electric current is then broken and the leather belt advances a certain distance, determined by the space it is desirable to have between the rows of buttons. The belts are actuated by the ratchet, H, mounted on the shaft of the pulleys, DD, which operate at certain regular intervals as soon as the cross bar, C, commences to rise.

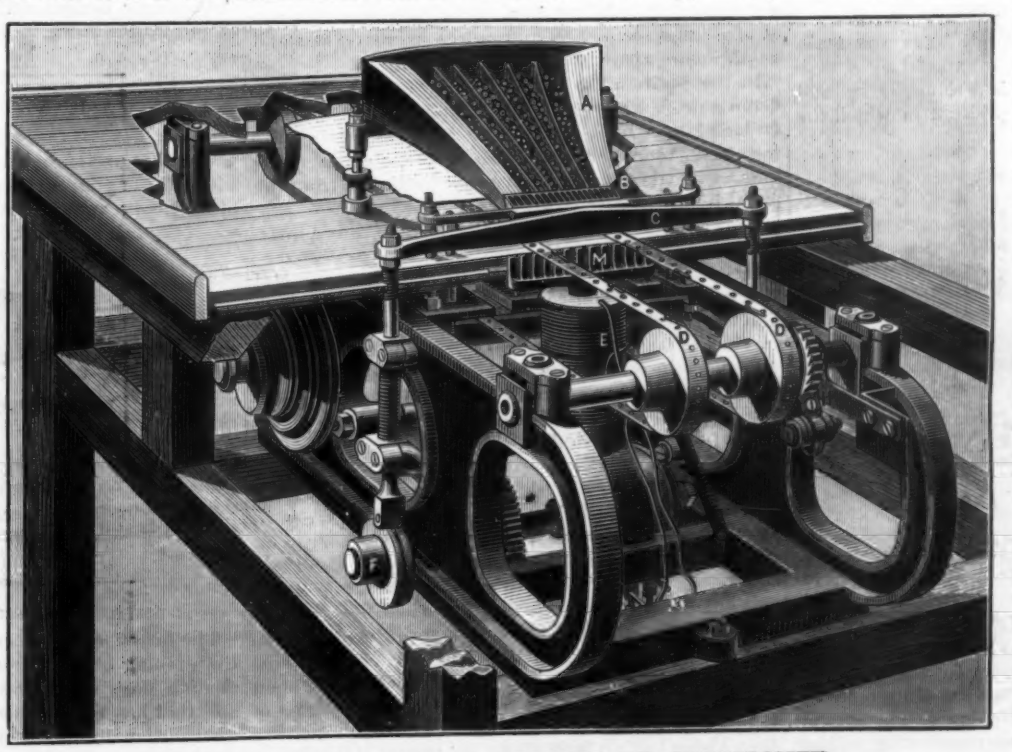
When one card is filled, by a special arrangement the ratchet is made to revolve several teeth at a time, so as to carry the next card without delay under the grooves which carry the buttons.

One workman is employed for placing the buttons in A, and according as the leather belts advance, to place the cardboards at the back part of the table and to remove those at the front part that have been already filled.

It is very interesting to watch this machine in operation. It was constructed by Mr. Olagnier, at the button factory of Messrs. Rosenwald. At the last exposition at the Palais de l'Industrie in Paris, visitors were always interested in watching a reduced working model, operated by a small Forest gas motor. Not far away was located another motor of the same system, which actuated the dynamo that furnished the current necessary for the electro-magnet of the machine. Of course, in ordinary practice all the power required is given by 1 motor.—*La Nature.*



A SIMPLE TRAVELING TOP.



MACHINE FOR CARDING BUTTONS BY ELECTRICITY.

THE death rate from chloroform is, according to a recent estimate, 1 in 1,600.

Cable Grips.

The office recently opened at 18 Broadway by the trustees of the Brooklyn Bridge, for the reception of models and diagrams of improved cable grips, has been well patronized. A record of all the inventions submitted is preserved in a special book. One of the most amusing communications received is that from a convict at Sing Sing. He suggests a circular track at each terminus of the bridge, so that the cars could continue on their course from one track to the other. Short cars, he adds, might be used to make the plan feasible.

Permission has been granted to the Westinghouse Air Brake Company to equip a car with their compressed air brake and a newly devised grip working on the same principle. The trial trip will probably be made within a few days. The experiment is at the company's expense. The compressed air apparatus has met with so much success when applied to surface roads, that it is expected to meet the requirements of travel on the bridge.

Governor Leon Abbett, of New Jersey, has submitted a grip very similar to that of the Westinghouse Company. These grips differ from that now in use on the bridge in being automatic in their action, while the present one is worked entirely by hand.

A SIMPLE TRAVELING TOP.

The ingenious toy here shown consists simply of a perforated disk, which can be easily whittled out of a piece of thin board, and a piece of strong cord of such a length that when the ends are tied together it will form a loop, through which the legs can be passed, as shown in the drawing. At opposite points on the edge of the disk are cut two small notches to receive the cord, as shown in the upper cut. The performer passes his legs through the loop, inserts the two lengths of cord in the notches of the disk, and then tightly twists up the cord. He now lets go of the disk and suddenly forces his legs apart. The untwisting of the cord rapidly revolves the disk, which will drop to the floor and run away for 50 or 100 yards according to the strength and skill of the manipulator.

Of course, the direction in which the cord is twisted will govern the direction in which the top will run, whether forward or backward. The force applied in untwisting may be increased by aiding the legs by placing the hands upon the knees. A very little practice will enable a boy to accurately gauge the direction in which the top will run and the distance. The disk should be of such a size that it will pass, without touching, between the two sides of the loop when they are parallel, as shown in the left hand figure. If made larger, the disk will not be free to drop from the cord when the latter has been completely untwisted.

Architects, Clients, and Builders.

It is a principle of law and equity that an agent is not allowed to make any profit out of the agency, without the knowledge and consent of his principal, beyond his proper remuneration; and any sums of money so obtained by an agent from any other source must be accounted for to the principal, who may claim it as money received to his use. Where, therefore, an engineer (and this case again equally refers to an architect) entered into a sub-contract with the contractor without the knowledge or consent of the employer, it was held that any surreptitious dealing between the contractor and the engineer was a fraud, and entitled the defrauded employer, if he came in time, to have the contract which was entered into without his knowledge or consent rescinded, and to refuse to proceed with it in any shape. So, on the other hand, the architect should not, without the knowledge of the builder, enter into a contract or engagement with the employer. If, besides the contract between the employer and the builder, there is a contract between the employer and the architect, not communicated to the builder, that the outlay shall not exceed a given sum, and the builder is, by the contract, subject to the orders of the architect as to what works he shall execute, this agreement is not binding upon the builder, and such restriction of the architect's authority by contract, as agent for the employer, cannot in any respect prejudice the builder's rights.

And in order to enable the employer to claim the benefit of a proviso that the architect was to arbitrate in all matters between him and the builder, it is essential that the fact of such a contract as above mentioned, between himself and the architect, should have been communicated to the builder, and distinct notice of such an engagement given to him previously to his entering into any contract, as otherwise the architect would be put in a position of undue bias.

If, however, the builder was aware of the agreement between the architect and his employer, and of the fact of the architect's interest in consequence, the builder would be bound.—*Alfred Emden, in the Architect, London.*

FROM the commencement of the cholera epidemic in Spain to the last day of July, the number of cases or cholera reported by the Spanish officials was 114,740, of which 33,973 proved fatal.

Youthful Inventors.

Eight pupils of one of the New York grammar schools, all of whom are under fourteen years of age, were among the exhibitors at the American Institute Fair. Although manual training is not included in the ordinary grammar school roster, it has been the practice of the principal of their school, Mr. McNary, to form a voluntary class in elementary shop work; and so successful has this effort been, that the models made by these youthful mechanics were judged worthy of a place in the machinery department. They comprise a pump, a dumbwaiter, a guillotine, a brick and mortar elevator, a screw press, a foundry crane, a derrick, two pile drivers, a vapor furnace, a blower, and an inclined railway. They were built to illustrate the applications of the six mechanical powers, and are very creditable to the intelligence of the scholars. The advantages of manual training are becoming more apparent every day. With the abolition of the apprentice system, it is indeed almost a necessary branch of education if the mechanic arts are to be brought to any degree of excellence. Many a man who is but an indifferent clerk or salesman would, if his ingenuity were turned in the right direction, make an excellent artisan. The reopening of these old avenues of occupation is a very desirable revival, and one which may be expected to produce practical benefits.

The Otto Gas Engine.

The important case of Otto *vs.* Steel, which had been fought for sixteen days before Mr. Justice Pearson, in the chancery division of the High Court of Justice, London, England, ended on Dec. 19, with judgment for the plaintiff. There was a formidable array of counsel and scientific witnesses for the prosecution, consisting of five lawyers and three scientific witnesses, and the other side was also ably represented. The point at issue was the validity of Dr. Otto's patent of 1876, which was strongly contended for already in Otto *vs.* Linford some years ago, and then decided in favor of the well-known inventor. The defendant admitted that his engine was an infringement of the Otto patent, and if it were valid, he was liable under the statute. The defendant sought to invalidate the first claim on particular objections not dealt with in the former case *vs.* Linford. From the plain evidence furnished by the scientific witnesses, the judge decided that the first claim is strictly accurate according to Dr. Otto's specification. He also considered that the mixture, when fired, is as specified by Dr. Otto, and has exactly the effect which he describes in his first claim; that his invention has not been anticipated by any of the specifications which have been put in before him; and that, therefore, Dr. Otto's patent is a valid and good patent.

The defendant was given one month, within which his engines should be given up. A petition for having the injunction suspended for a longer term was refused on the ground that this action was the second in which the court had declared in favor of the patent.

SAUCEPAN AND COVER.

As generally made, the perforations in the main cover of a saucepan are closed or exposed by a supplementary lid (Fig. 1), which is a self-opening and closing one, according to the position in which the

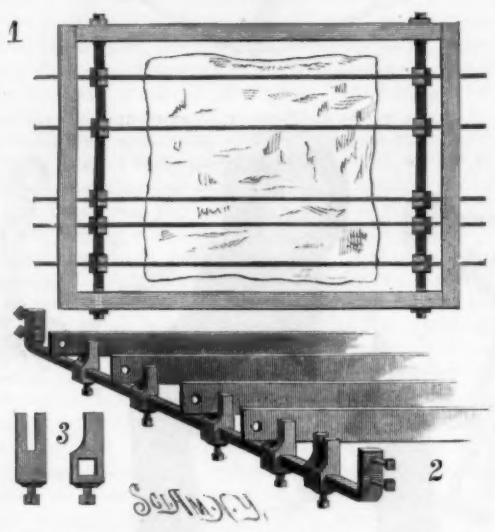
BRADFORD'S SAUCEPAN AND COVER

saucepan is held. In the invention here illustrated, a sliding lid (Fig. 2), provided with suitable perforations to correspond with those in the main lid, is substituted for the swinging one. There is no tendency of this lid to open when carrying the saucepan about, and it is only by specially adjusting the lid before tilting the saucepan that the draining openings will be exposed to pour off the liquid. The amount of exposure may be regulated as required by adjusting the slide to bring its apertures either wholly or only partly over those in the cover. The main cover is held to the body of the saucepan by a clip placed opposite the handle and by a sliding clip placed upon the handle. These clips hold the lid very securely, and yet permit of its easy removal when necessary.

This invention has been patented by Mr. George A. Bradford, of Bergen Point, N. J.

IMPROVEMENT IN STONE AND MARBLE SAWING MACHINES.

This invention is designed to be attached as a permanent fixture to any stone or marble saw, to provide for a simple and positive method of accurately spacing the saws to any required widths, and to hold the saws securely in a truly vertical position. The saws work independently, so that any one can be taken and replaced in its true position without disturbing the gauge. This construction dispenses entirely with the use of wooden gauges; and slabs of stone or marble from five-eighths of an inch thick to as wide as the gang will admit can be sawn accurately. Fig. 1 shows a plan of the saw frame with this device attached, the saws being spaced ready for work. Fig. 2 shows the device detached and



COYNE'S ADJUSTABLE STONE AND MARBLE SAW GAUGE.

the method of spacing the saws. The lugs, shown detached in Fig. 3, are movable on the bar, and can be held securely in any desired position by means of set screws underneath them. Any of the usual methods can be used to bring the saws up tight endwise.

Further information can be obtained by addressing the patentee and inventor, Mr. James F. Coyne, 424 North Halstead Street, Chicago, Ill.

PHOTOGRAPHIC NOTES.

Photographing by the aid of a new Magnesium Light.—On the 26th ult., at a meeting of the New York Amateur Photographers' Society, a new apparatus for burning magnesium ribbon, designed by the president, Mr. F. C. Beach, was successfully employed for lighting the room and the audience when a photograph was made.

The apparatus consisted of two metal boxes about 14 inches square by 8 inches deep, having bright reflectors inserted at their back, while the front was inclosed with a pane of glass; at the top of the interior was soldered a spring clasp, resembling a garter clamp, and immediately below, in a vertical line, were a series of wire rings, secured to cross wires, arranged two and a half inches apart.

In the bottom, just under the lowest ring, was soldered a projecting wire with a sharpened point, half an inch long. Half an inch on each side of the wire were brass binding posts, which extended through the bottom to the outside, and were insulated from the metal by gutta-percha washers.

Near one side of the box, in the bottom, was a quarter inch inlet tin tube, its inner end being protected or covered a short distance from its mouth by a metal disk one inch in diameter, the latter being held in position by suitable supports. The outer end projected two inches below the bottom.

Each of the outer tubes of the boxes was connected by a rubber pipe to a T, and from the latter to an oxygen gas cylinder (in which the gas was compressed under pressure) located at one side of the room near the operator.

By two No. 16 insulated copper wires the respective binding posts of each box were connected in series to an "Aurora" bichromate of potassium battery, consisting of four large cells, placed near by on the floor, the wires extending from the battery to an open circuit key fixed on the table of the president.

In each box, suspended from the spring clamp at the top, and passing through the wire rings below, were tapers of magnesium ribbon, made by taking a ribbon 48 inches long and folding it upon itself in lengths of ten or eleven inches. The lower end of each taper was then about half an inch above the upper extremity of the projecting pin in the bottom of the box.

The brass binding posts on the inside were connected by a fine platinum wire, No. 40 gauge, and upon the metal pin was put a small piece of sponge about as large as a small marble.

The object of the arrangement thus described was to furnish a means for simultaneously igniting two or more magnesium tapers arranged at varying distances apart, and at the same time to burn them in an atmosphere of oxygen gas. By thus confining the white oxide fumes given off, the light was softened and a better effect obtained.

Just before operating, the sponges in each box were dipped in alcohol and then mounted on the wire pins, the platinum wire was arranged to come in contact with the sponge, and, when all was ready, the boxes were charged with oxygen gas from the cylinder below; then the operator, by pressing the electric key, heated the platinum wires to a red heat, which in turn ignited the alcohol on the sponge, and that flame immediately, nearly simultaneously, ignited the magnesium tapers; at the same moment the exposure, which lasted about ten seconds, was made by removing the cap from the lens in the ordinary way.

The experiment was quite novel, and proved to be very satisfactory to the assembly and the inventor.

After the exposure was made, the sensitive dry plate was developed in an adjoining room, and an excellent negative of the audience obtained.

The particular advantage claimed for this system was its use in the photographing of large halls, theaters, etc., where it was necessary to locate and distribute the lamps in inaccessible places or at high elevations.

The manner of burning magnesium powder mixed with sand, thrown into a metal funnel under which was an alcohol lamp, was shown, a brilliant flame of fire resulting. The powder, being very light, would not fall rapidly and regularly through the funnel (which should have a short mouth) unless the inside was smooth and highly polished, and the angle quite acute.

Very probably, further improvements will be made in the use of the magnesium light as an aid in photographing interiors and for making portraits at night.

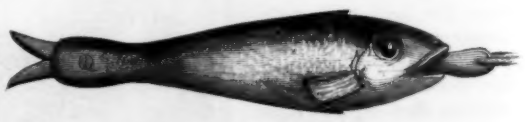
The Moon and Us.

The first of a series of ten scientific lectures, to be delivered before the Science Matinee Club, at the Hotel Brunswick, New York, was that by Prof. Young, of Princeton, on the moon, which was illustrated by the stereopticon. The lecturer spoke of our satellite as the petrified daughter of the earth, since it is destitute of life, air, and water.

The moon has always been a favorite subject of study among astronomers, on account of its proximity and because it is the only heavenly body, with the exception of the sun, that exercises an appreciable influence upon our planet. The lunar temperature is one of violent extremes. In the dark spots, under the shadow of the lunar Alps, it is calculated to be about 200 deg. below zero; while in the localities exposed to the sunlight, the temperature of boiling water is supposed to prevail. Beyond her influence upon the tides, the moon has little power in earthly affairs, in spite of the popular belief in her disturbing action upon the human brain or her assistance in the germination of the sown grain. Were she annihilated, the temperature of New York, Prof. Young said, would be reduced one degree. In her present orbit, however, she has absolutely no influence upon the weather. In conclusion, the lecturer begged artists not to paint their crescent moons upside down, as Hogarth has done in one of his pictures.

IMPROVED FISH HOOK.

In our issue of December 19, we described and illustrated a novel fish hook, invented by Mr. Cornelius Lie. The engraving then presented showed the points of the hooks spread out by the strain upon the line when the fish is caught. The accompanying cut shows



LIE'S IMPROVED FISH HOOK.

the hooks concealed in the body of the artificial fish, there being no strain upon the line. All further particulars concerning this patent can be obtained from Mr. J. J. Eskil, of Florence, Wis., to whom it has been assigned.

A Great Cold Wave.

The heavy snow storm that reached New York on the evening of the 8th of January, and for many succeeding days was followed by such intense cold, was one that has not been equaled in severity and wide distribution by any storm of the past half century. At Atlanta and other points in Georgia, the thermometer has been as low as zero, while at Charleston, S. C., it has gone six or seven degrees below. In Florida, such cold has not been felt since the memorable winter of 1835, when the orange trees were killed. The damage to the orange crop this year has been great. The temperature all over the State has been unusual. At Jacksonville, the thermometer stood at 16°, while Tampa Bay, which is usually free from even frost, it was at 15°.

THE BIG BEND TUNNEL IN BUTTE COUNTY, CALIFORNIA.

Since that famous year of 1848, when Marshall found his gold nuggets in the race-course of Sutter's sawmill on American River, California has been noted in the history of the precious metals as one of the most bountiful and at the same time one of the most constant producers. The legitimate industrial pursuit of gold has become so characteristic of her people that the bare mention of her name is sufficient to call up a picture of quartz ledge and placers. Thirty odd years spent in persistent attention to one calling has given her a pre-eminence in the industry as gratifying as it is remarkable.

The machinery which has been devised to work her auriferous quartz and gravels is unsurpassed in the entire world. A distinct type has been evolved. The machinery of the Pacific is to-day the model for the machine builders of all gold-producing countries. Her enterprise in the search and working of the sources of the precious metals has been marked by an unprecedented magnitude and boldness. Her hydraulic mining has been on a scale sufficient to permanently change the topography of the country. Whole mountains have been washed away. The beds of ancient rivers have been followed, and deprived of their precious burden. The course of living streams has been checked and altered. One hundred million dollars' worth of gold, that was at one time mingled with the sands of these river bottoms, has been recovered in three years, and is now added to the commerce of the world.

All of these changes have been accomplished, all this wealth has been gathered, in but a comparatively short period of time. With the appropriation of the more eligible sites and the exhaustion of the more available treasure, however, it has been necessary for the gold miner to turn his attention to works of even greater difficulty. This more closely guarded gold has only been brought within reach by the wonderful advance in engineering science and by the perfection of the tools and mechanisms of the engineer.

The early discovery of gold having been made on Feather River led to a most careful prospecting of the length of its entire bank. Considerable value has been taken from its bed. Portions of the river have, however, on account of their impetuous currents and steep banks, remained inaccessible to the miner even after their value became known. The almost semicircular curve in Butte County denominated the Big Bend is a case in point. Occasional washing of its bars and hurried incisions into the gravel of its bed proper have disclosed a promising richness, and made further working very desirable. The rocky canon through which the river flows for fourteen miles before disengaging its waters from the Big Bend is wild, and accessible only with difficulty. The river itself has a sufficient fall to create a strong current, and a volume seldom less than 80,000 miners' inches. These circumstances have never permitted more than casual operations.

Both above and below the Bend, very profitable enterprises are said to have been carried out. A company of Buffalo capitalists, induced by these considerations, determined to investigate the possibility of driving a tunnel across the base of the semicircle, and by thus draining the fourteen miles of river bed included in the Bend, make it feasible to thoroughly work the promising gravels. During the summer of 1882, careful surveys of the region were made by Mr. N. A. Harris, the superintendent chosen by the company, and Mr. James McGann, at that time official surveyor for Butte County. At the completion of the surveys, it was found that a tunnel about 12,000 feet long, with an average grade of 32·1 feet to the mile, would carry the waters from above the Bend to Dark Canon, from which they would pass to the West Branch, and eventually reach the main river at a point some distance below the Bend. By diverting the waters in this manner, the entire bed of the river for a distance of about fourteen miles would be exposed to mining operations.

As the scheme was regarded as entirely practical by several experienced engineers, the company determined to carry it into effect. In the following November, work was begun by blasting off the surface of the rock in Dark Canon, and getting a solid working face for the air drills. It was decided to run the tunnel at an upward grade of 29·7 feet to the mile until within 300 feet of its upper end. From this point, all of the unused grade will be utilized in giving a high velocity to the inflowing waters. The drilling proper began on the 18th of November, 1882. Two days later a night shift was put to work, and on the first of the following month three shifts of eight hours each were established. When the operations first began, the plant consisted of a No. 4 Burleigh air compressor, so arranged that it could be driven by steam or water power; an air tank, 4 by 16 feet, a No. 3 Knowles pump; a 2 by 8 ft. Lewellyn heater; an 8 ft. Knight water wheel and fittings; a Buffalo drill carriage mounting four drills; and a complete tubular boiler, 5 by 16 feet. Since then, there have been added 4 Burleigh tunnel drills, a No. 4 Clayton duplex air compressor, a No. 5 Baker blower, and an engine to run the blower.

The water wheel is supplied from a ditch carrying 100 miners' inches of water taken from Dark Canon. An 11 inch iron pipe, having a vertical fall of 375 feet, conveys the water to the wheel.

The progress of the work since the beginning is shown in the following table:

Distance by hand prior to Nov. 18, 1882	26 ft.
" " drills to Dec. 31, 1882	373 "
" " " " Jan. 1, 1884	3,508 "
" " " " Jan. 1, 1885	3,090 "
" " " " Jan. 1, 1886	3,855 "
Total to Jan. 1, 1886	10,847 "
" length of tunnel	12,007 "
Remaining distance	1,160 "

No full record of work was kept prior to Jan. 1, 1883, but since then it is complete. In 1883, six days' time, or 18 shifts, were lost; in 1884, four and two-thirds days, or 14 shifts, were lost; and in 1885, only three and two-thirds days, or 11 shifts. This represents all time lost by reason of breakage of machinery, cleaning boiler, and all other causes.

The least distance made in any month was in August, 1883, when only 175 feet were accomplished. The greatest distance made in the same time was in September, 1885, when the heading was advanced 405 feet. The monthly average for 1883 was 291·9 feet, and for 1885 was 327·2. The character of the rock has changed during the progress of the tunnel, and therefore the results of the different months are not strictly comparable with each other. During the first nine months, an easily penetrated slate formation, with occasional stringers of quartz and granite, prevailed, with the exception of about 200 feet of very hard diorite. The rock was sufficiently firm to dispense with all timbering. In several cases, bodies of rock were passed through, yielding from eight to fourteen dollars per ton in gold and silver. For several months after this, the rock continued hard and difficult to work; but when the tunnel had been driven about six thousand feet, or just half the distance, a black slate was encountered, which, though close and hard, and requiring a large amount of explosives to blast it, permitted excellent speed with the drills.

The tunnel is being constructed with a width of 16 ft. and height of 10 ft., giving a cross sectional area of 160 square feet, or 23,040 square inches. From an elaborate series of measurements made at the site of the upper end of the tunnel, it is calculated that an outlet of this area will suffice to carry off the waters of the river for a period of from seven to nine months out of each year. Just at this point the river is narrow and inclosed between steep banks, so that it offers a favorable site for a dam.

In driving the heading, each of the three shifts is made up of a boss, 4 drill men, 4 helpers on drills, 1 powder man, 1 car man, and 2 laborers. The outside force consists of 2 blacksmiths, 2 helpers, 1 machinist, 2 engineers, and a number of other laborers varying with the requirements of the work. The ventilation of the tunnel is kept up by means of the air drills and the Baker blower. When the drills are in operation, the exhaust furnishes all the fresh air needed.

The blower is located at the mouth of the tunnel, and is driven by means of a separate engine. It connects with an eleven inch iron pipe, which extends up the tunnel to within two hundred feet of the working face. The blower is used exclusively as an exhaust for extracting the smoke and bad air from the heading. It is only put in operation ten or fifteen minutes before a blast, and at the same time the air compressor delivers a volume of fresh air directly into the face of the working. This arrangement permits the men to resume work within about fifteen minutes after blasting. Both blower and compressor are kept at work until the debris has been removed and the drilling recommenced, when the blower is shut down until just before another blast. A track of two foot gauge, laid with sixteen pound T rail, extends from the heading. The grade being uniformly down, the removal of the rock is not difficult. The movement of the cars is effected entirely by means of mules, six animals being kept at the tunnel for this purpose. The trains are composed of from ten to twelve cars, and the number of daily trips is regulated entirely by circumstances.

In addition to the main part of the enterprise, that of driving the tunnel, an immense amount of work has been necessary on the surface. Roads have been built in order to facilitate the transportation of supplies from Oroville, some sixteen miles distant, and have been extended over different parts of Big Bend Mt., so that timber can be conveniently brought to the sawmill and furnace. Fourteen miles of pack-animal trail have been built around the Big Bend, in order to make all portions of the claim accessible. A private telephone wire has been built to Oroville, and in time will be extended to all parts of the trail. The company has bought several thousand acres of land, in order to cover its tunnel site, provide ample timber reserves, and protect it against actions for damages arising out of the backing up of the water above the proposed dam or out of the increased volume which, as soon as the tunnel is completed, will find an outlet through Dark Canon and the West Branch. The president of the company, R. V. Pierce, Esq., of Buffalo, N. Y., informs us that the tunnel itself will probably be completed about April 1, and that they hope to do a good season's work in treating the gravel during the coming summer.

When the river is turned into the tunnel and its bed drained, several mining camps will be established at favorable points on the Bend, so that the gravel can be worked in a number of localities at the same time. The treatment will consist in loosening up the gravel, raising it, and running it through sluices. The gold, from its greater specific gravity, collects on the bottom of these sluiceways, while the earth and debris are carried along by the stream of water, and will be deposited at convenient points on the bank. The water for the supply of these sluices and "long toms" will be taken from the river above the dam, by means of ditches, and from the smaller tributaries that enter the Bend itself. The illustrations on the front page show the tunnel site and workings.

No materials exist for the formation of even an approximate estimate of the amount of gold which may be expected to be recovered from these gravels. Practical miners of the neighborhood state that it will be from fifty to one hundred and fifty million dollars. This estimate, however, is only valuable as an experienced guess, for there are no data at hand which would warrant one in venturing upon figures.

English Patents in 1885.

The Board of Trade has appointed Sir Farrer Herschell, the Earl of Crawford and Balcarres, and Baron Henry de Worms, M. P., to be a committee to inquire into the working of the patent office under the act of 1883. The *Ironmonger* thinks the step is a very proper one and very well timed, for, as the act has now had two years' trial (it came into force on January 1, 1884), it is possible to ascertain how far it has really proved an improvement on the previous law, and what are the defects which practical trial may have brought to light. Certain defects have already been discovered, and have been remedied by the short amending act passed last session,* and there will probably not be much question among those familiar with patents that, whether or not any further alteration in the law is required, there are many points in which the practice of the office leaves considerable room for improvement.

On the whole, it need not be doubted that the act has given satisfaction to inventors. Reduction in fees was what they mainly clamored for, and this they got, at all events, in the initial stages. If the number of patents applied for be taken as a criterion of the value of the act, there can be no further question about it, for in this respect its success exceeded the most sanguine expectations of its promoters. In the first year of the new act there were 17,110 applications, not far from three times the number in any previous year, and in the year just past there were 16,101. This falling off of 1,000 may easily be accounted for by the fact that there was a sort of accumulation of inventions at the beginning of 1884 waiting for cheap patents, as is shown by the rush to the patent office in the earlier months of that year.

About 20 per cent of the applications are from persons not resident in the United Kingdom, and the suspicion cannot but arise that a certain proportion of this large percentage are applications for patents made with the idea of preventing the working of an invention in England, and therefore enabling its owners to supply English markets with goods manufactured abroad. Under the act, the Board of Trade has power to compel an inventor to grant licenses. But the *mandamus* by which this provision is to be enforced cannot reach the foreigner, and the Board has no power to cancel the patent. It may be thought that, in any case in which there had been failure on these grounds to obtain a license, the fact of having applied for one would be sufficient defense to an action for infringement; but this is one of those questions which remain matter for speculation until the courts have had their say upon them.

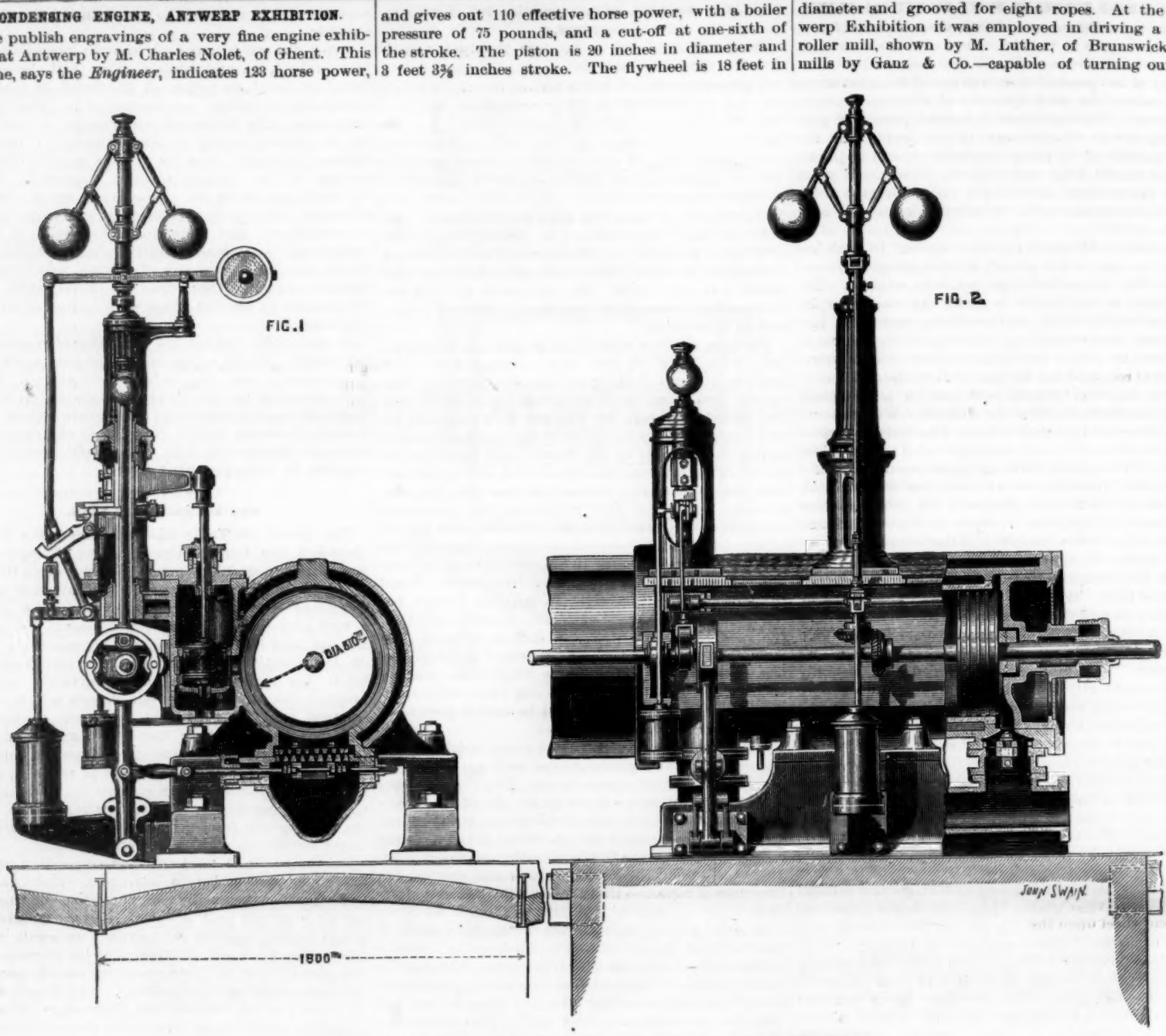
The Tehuantepec Ship Railway.

Captain James B. Eads and Hon. William Windom, president of the Tehuantepec Ship Railway, recently appeared before a joint meeting of the Congressional Committee on Commerce to advocate the passage of the ship railway measure introduced by Senator Vest in December last. A model showing the workings of the railway was exhibited and explained. All of the members present manifested the greatest interest in the subject. The case was thoroughly presented to them in all its details. A most favorable impression was evidently made upon the gentlemen of the committee, and while the fate of the measure has not yet been assured, the chances are thought to be in its favor.

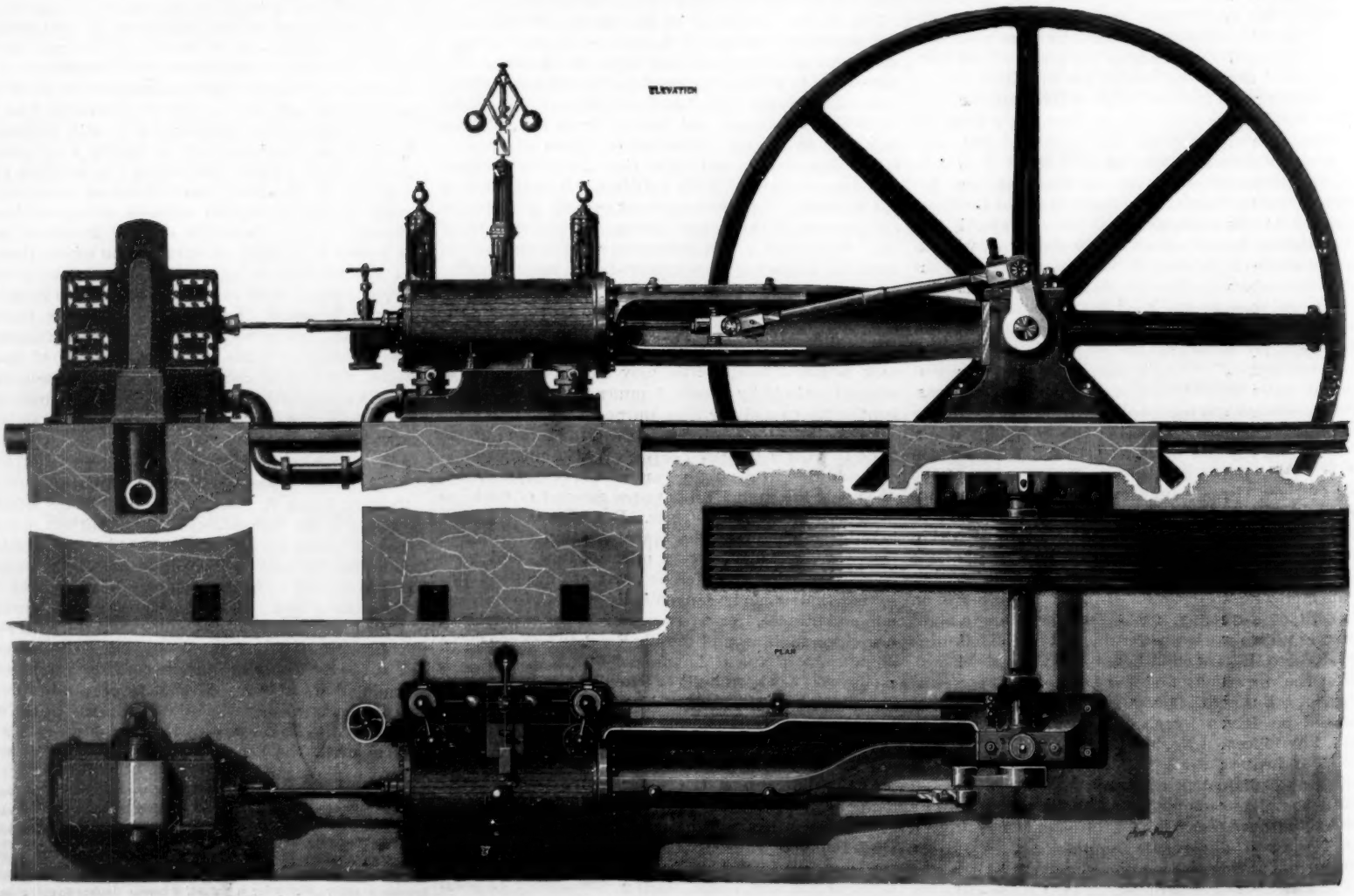
* This act, passed August 14, 1885, comprises several sections, but most of them pertain to rules of practice in the patent office. But that affecting inventors most generally is the one declaring that neither the drawings nor specifications in abandoned applications shall be open to public inspection or be published. Another section determines the right of several persons to apply jointly for a patent, whereas doubts on this point had arisen.—ED.

CONDENSING ENGINE, ANTWERP EXHIBITION.

We publish engravings of a very fine engine exhibited at Antwerp by M. Charles Nolet, of Ghent. This engine, says the *Engineer*, indicates 123 horse power, and gives out 110 effective horse power, with a boiler pressure of 75 pounds, and a cut-off at one-sixth of the stroke. The piston is 20 inches in diameter and 3 feet 3⅛ inches stroke. The flywheel is 18 feet in diameter and grooved for eight ropes. At the Antwerp Exhibition it was employed in driving a large roller mill, shown by M. Luther, of Brunswick—the mills by Ganz & Co.—capable of turning out 500



DETAILS OF CONDENSING ENGINE, ANTWERP EXHIBITION.



CONDENSING ENGINE, 120 HORSE POWER, ANTWERP EXHIBITION.

sacks of flour per day. The engine was exhibited *hors concours*—that is to say it did not compete for a prize, and was sold to MM. A. & N. Buysse, millers, of Wettern.

The cylinder is carefully jacketed, and the valves are all worked by cams on a horizontal shaft driven by bevel gear. The exhaust valves are of the grid-iron type. The steam is actuated by double beat puppet valves, as shown in the cross section. The trip gear is extremely simple. A detent actuated by a spring engages with a vertical rod. The detent is carried by a frame, which is lifted by the cam on a rotating shaft. The vertical rod is provided with an arm, to which is secured the valve rod. The governor controls an inclined lever, on the end of which is a toe. This toe comes in contact with the trigger of the detent before referred to, and pulls it down as soon as the frame has reached a given height, or more strictly, it prevents the trigger from continuing to rise with the frame. This pulls the catch out of the vertical rod, and allows the valve to drop and so close. The angle of inclination of the toe-carrying lever is settled by the governor, which thus controls the ratio of expansion. An examination of the cross section through the cylinder will make this quite clear.

The engine exhibited at Antwerp furnishes another example of the great perfection to which Belgian engineers have carried the art of steam engine construction.

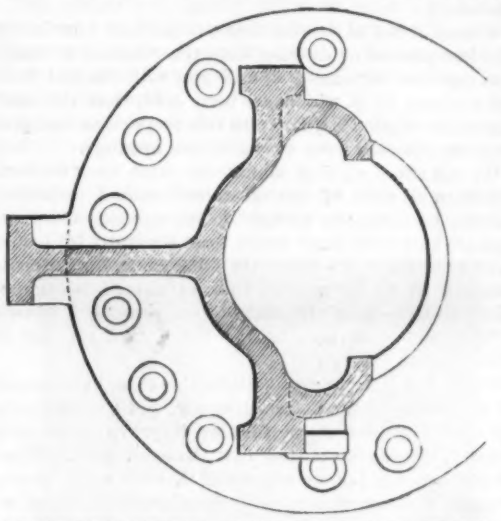
The Inaccuracies of Car Wheels.

At a recent meeting of master car builders at Boston, Mass., it was stated that the 24 inch chilled iron car wheels were liable to be ¼ inch different in ranges of diameter and an equal amount in eccentricity, both variations being caused by irregularities in cooling. The sentiment of the meeting was reported to be against grinding the wheels to accuracy in concentricity and diameter, as involving a useless expense. These opinions do not seem to be warranted by an examination of the facts. The evils of uneven wear of chilled wheels are well known, and universally ascribed to skidding the wheels by excessive application of the brakes, but as such use of brakes is forbidden, and at present somewhat infrequent, is it not more probable that it is in great measure due to the enforced slip caused by fastening wheels of different diameter upon the same axle? Taking the extreme case of a 24 inch wheel and a 24¼ inch wheel upon the same axle, in a 100 mile run there would be a difference of 871 revolutions, or 5,529, feet in the distance compassed by each of the wheels, and one wheel or the other must have slipped on the track more than a mile, with its consequent wear, which would soon find the softest parts in the wheel, not to mention the excess of tractive force required to do this extra work. Such of the wheels as were ¼ inch eccentric would be raised 1,751 feet during the 100 mile run; and the one-third of a mile of vertical component must pound rolling stock and roadway. Some of the best managed American railways use, on their passenger cars, wheels which have been ground, but this comprises only a small proportion of all the car wheels in use. The Pullman parlor cars use wheels which are made of an annular mass of paper, 36 inches in diameter, pressed between an iron boss at center and surrounded by a steel tire; thin iron plates bolted to each side protect the paper against exposure. There are other forms of car wheels made of pieces of iron with rubber between the iron body of the wheel and the steel tire, and they have given excellent results, but the excessive first cost has retarded their introduction.

A THICK vein of coal was struck at a depth of 345 ft. near Chatham, Ill.

Electrical Swords.

The recent production of the play of "Faust" at the Lyceum Theater, London, called to its assistance, besides the charming acting of Mr. Irving and Miss Terry, the scenic possibilities of electricity in a manner never before attempted. In the duel scene between Faust and Valentine, Mephistopheles takes a sinister part; and each time that he crosses his sword with that of Valentine, there is a flash of fire, a continuous blaze of electricity. The combatants have a metal plate under foot connected with a battery, and both Valentine and Mephistopheles have metal soles to their shoes, connected by a wire with their sword blades. As their swords touch, an electric circuit is completed. The continuous discharge of electricity is caused by the edge of the weapons having teeth like a saw, each of which gives off its spark. Faust is not a "conductor," and consequently his sword is harmless.

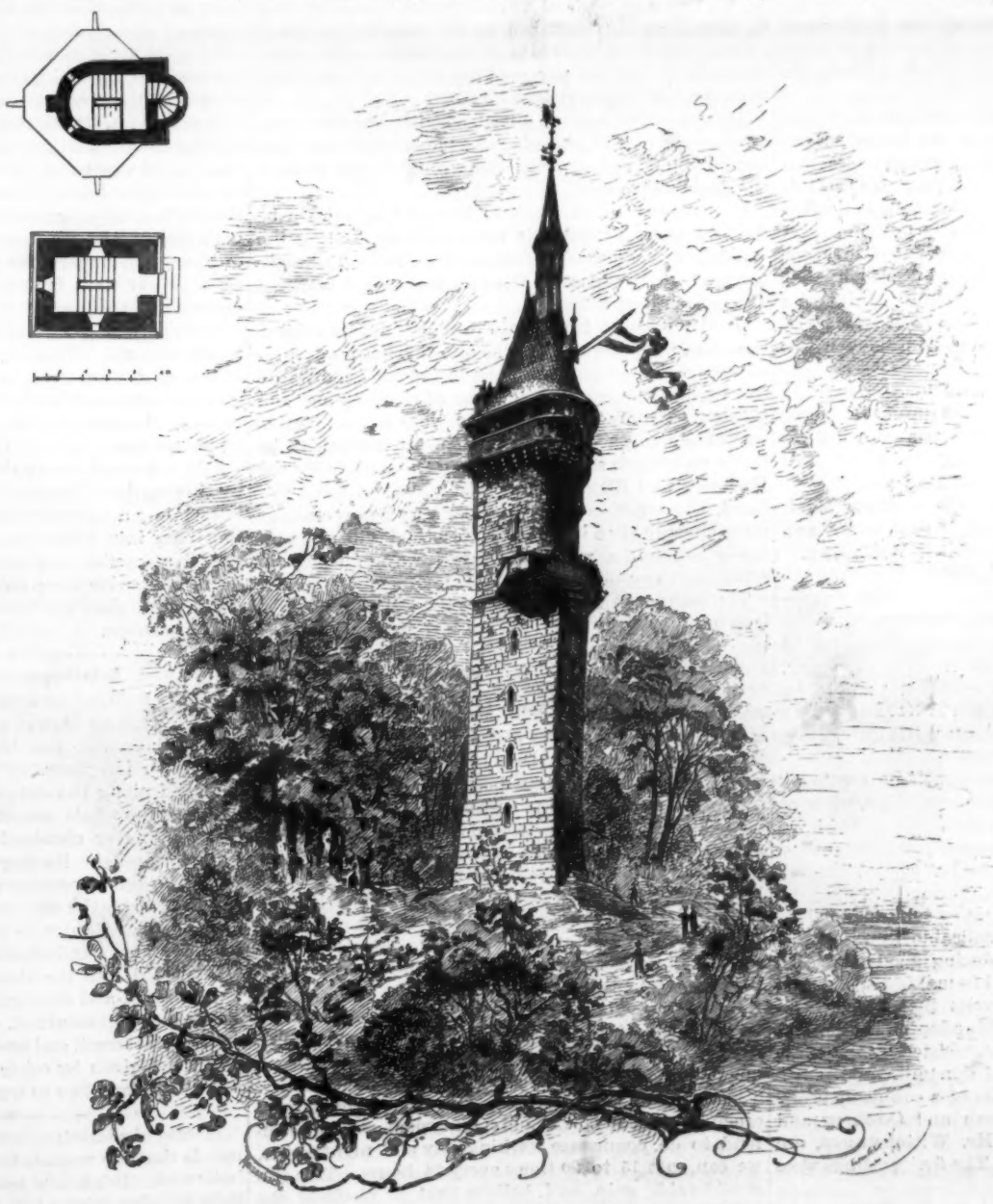


CONDENSING ENGINE.—CROSS SECTION OF FRAME.

DESIGN FOR AN OBSERVATORY TOWER.

Our engraving shows the prize design for an observation tower for Heilbronn, which is soon to be erected by Messrs. Von Eisenlohr & Weigle, of Stuttgart.

The plan is the result of a universal competition. Of the fifty-four designs presented, this one drew the prize, and was recommended for execution. The programme pointed out that special attention should be given to the finish of the upper part of the tower, as it is to be surrounded by a growth of trees, 46 feet high; that a flight of easy steps should lead to the top; and that the cost of construction should not exceed 12,000 m., or about $3,000.—*Architecktonische Rundschau.*



PRIZE DESIGN FOR AN OBSERVATORY TOWER.

Bleaching Drawings made upon a Photographic Print.

BY W. W. BODE.

Reading in one of your late issues of a method of bleaching away a photograph made on good Bristol board, after the same had been worked over by the artist, so as to admit of its being reproduced by photo-engraving processes, recalls to my mind many of the unpleasantnesses encountered in attempting to bleach drawings made upon a photographic print. The principal objection which presented itself was the dinginess or yellowness of the paper after bleaching, notwithstanding the precaution of having it thoroughly washed, and even after repeated applications of flowing with the bleaching solution made after the well known formula of about one quart absolute alcohol to one ounce bichloride mercury.

The dingy yellow brown on the paper, not permitting a strong black and white negative to be made, would be fatal to a good reproduction; if the drawing happened to be one with a large proportion of shadows, the dinginess increased proportionately, and more so where the drawing would take a couple of days or more to complete.

To remedy these difficulties I resort to the following method, which has always given me clean, white results, and is one which can be relied upon.

Procure good plain paper, salted, and float the same on a silver bath, made as follows:

Distilled water	9 ounces.
Nitrate of silver	1 ounce.

Dissolve the silver in the water and separate three ounces of the solution from the rest, to which add liquor ammonia until the oxide of silver formed is redissolved and the solution is again clear. Then add it to the remaining six ounces of solution. Oxide of silver will again be formed, which can be allowed to settle to the bottom, or decant and filter same.

Give sufficient time in printing to get out all the detail, but do not print very strongly; thoroughly wash until the print becomes red (do not use warm water). When the excess of silver has been thoroughly removed by several changes of water, place the same in freshly made hypo.; let it be rather weak and about equal proportions of hyposulphite of soda and good bicarbonate of soda. It should remain in this solution about ten or twelve minutes only, and not longer than that time. You desire simply to fix the image temporarily and not permanently. Thoroughly wash the same in several changes of clean water, and then mount on cardboard.

The drawing should be made as soon as possible after the paper is thoroughly dried, for, if kept several days, the image will begin to show signs of dissolution. After the artist has outlined enough for his guidance, flow on the bleaching solution as you would collodion, and in fifteen minutes you will have a pure white paper without the slightest trace of a photographic substratum. — *Lithographer and Printer.*

A PLAN for rendering paper as tough as wood or leather, it is said, has been recently introduced on the Continent. It consists in mixing chloride of zinc with the pulp in the course of manufacture. It has been found that the greater the degree of concentration of the zinc solution, the greater will be the toughness of the paper. It can be used for making boxes, combs, for roofing, and even for making boots.

Correspondence.

Strength of Walls.

To the Editor of the Scientific American:

Being an admirer of the splendid illustrations which you issue, I take the liberty of stating what I know of the relative strength of brick and stone walls. I have seen in your December issue an article taken from the *Brick and Tile Gazette*, saying: "A two-brick wall is equivalent in strength to one in solid masonry two feet." As a mason I feel inclined to contradict such, when no proof is given only that bricks absorb more moisture. Now, I say if a stone wall two feet in width is properly built, it is equivalent in strength to a 2 foot 6 inch brick wall. JOHN TREACY.

New York, January, 1886.

Boiler Explosion—St. Mary's Church, Fort Wayne, Ind.

To the Editor of the Scientific American:

The explosion of the boiler of the steam heating apparatus in St. Mary's Church, in this city, which occurred on Wednesday, Jan. 13, between 12 and 1 P.M., made a complete wreck. St. Mary's Church was a large and stately edifice. The boiler was in the cellar, at the east end, under that portion of the church where the high altar is situated, and located in a recess built out from the east wall of the church. One portion of the force of the explosion apparently drove up through the floor overhead and out through the roof of the recessed portion, hurling that portion of the roof, which was of tin, over on the parsonage, which is situated close by, east of the church; the other portion tore up the floor of the church, and demolished everything within its reach, as can be easily imagined by one of the boiler heads cutting its way to near the front door. The large stained glass windows, with their frames, were blown into the middle of the street.

So quick and violent was the force, that many of the window frames were split from top to bottom, and that portion having the lugs upon them, which held them in the walls, were left in their places; at the same time, the massive side walls were thrown out of line at the top, and now overhang about two feet from the perpendicular. The large windows, sash and all, away up in the belfry of the tower, were blown out. There is a double row of columns running through the church, which apparently sustained the roof.

A schoolhouse on the south side, immediately adjoining the church, is so shattered that it has been abandoned. The priest's residence, on the east, is in the same condition, and will have to be taken down. In fact, all is ruined.

Is it possible that the missing boiler sheet was blown to atoms? It is nowhere to be found. Even if it was a bad one, it held on long enough to create a force more destructive than dynamite, for that is generally local in its effects, whereas this boiler explosion was general and extended in its action.

It is said the safety valve was weighted to carry thirteen pounds of steam to the square inch; that would be reasonable for so large a church. But who knows what the condition of the valve itself was? Who knows whether it had ever been lifted since it was started last fall?

A boiler that will hold together long enough to cause such fearful havoc of life and property ought not to be blamed if it blew up, nor the makers censured. It would be interesting to know how much pressure it sustained before it gave out.

It is safe to say that ignorance the most profound, in the use of steam, had charge of that boiler, and a fearful penalty has been the forfeit. WM. LYNE.

Fort Wayne, Ind., January 17, 1886.

Mitis, or Wrought Iron Castings.

As this new process is now in successful operation at the works of the Worcester Malleable Iron Company, Worcester, Mass., it will be interesting to note its chief characteristics and values. Mr. T. Nordenfelt, in a paper read before the Iron and Steel Institute, May, 1885, gives the following among other particulars:

I have called our produce "wrought iron castings" because they are made of wrought iron alone, without any other additions than such chemicals as we have found most suitable for our purposes, and I have called these castings "Mitis castings," the Latin word "mitis" meaning, of course, mild, flexible, or ductile.

The origin of this invention is as follows: We had at Carlsvik, in Stockholm, a malleable iron foundry which fairly succeeded in producing good malleable castings, but we did not succeed in making these castings so absolutely free from faults that I could use them in my gun manufacture. We adopted the method originated by Mr. Wittenstroem, assisted by the experience of Mr. Ludwig Nobel, of dynamite and petroleum reputation, and the results of a couple of years' experiments by Messrs. Faustman and Oestberg and myself, with the guidance of Mr. Wittenstroem, are what you now see before you. The first castings were produced in January, 1885.

The raw material we first used was Swedish wrought iron scrap, such as horseshoes, rivets, etc., and the castings we obtained from this raw material were found to have about 20 per cent higher tensile strength than the wrought iron used—the tensile strength being 24 tons per square inch and upward—and this percentage of gain in strength has been maintained for other raw materials.

We could not at first see that our castings were in any way less pliable or ductile than the Swedish wrought iron used as raw material, and you will observe from the samples, all of which are bent cold, that the castings show as good a quality in this respect as can possibly be expected from wrought iron forgings.

We got rid of all slag, and at the same time we were free from all risks of the delamination and imperfect welding occurring in wrought iron forgings. Our castings are therefore more dense than wrought iron, and have practically no fiber; they have the same tensile strength in all directions, this advantage being obtained at the cost of the slight loss of elongation caused by the absence of slag, and by the virtual absence of fiber.

We do not alter to any considerable extent the chemical properties of the material we use, and I need hardly say that I do not claim that we improve (more than already stated) the actual raw material used. What we put into the pot we get out of it, with such alterations only as are caused by the treatment to which we subject it; therefore, if we use iron free from all impurities, we obtain exceedingly good castings, and if we use iron with a very large percentage of phosphorus we naturally obtain proportionately brittle and unsatisfactory castings. A pure iron, such as refined iron from Middlesbrough, gave us castings to all intents and purposes as good as the best English forgings, while such perfect raw material as hematite puddle bars gave us castings which were equally as good as, if not better, in every respect, than, those produced from Swedish wrought iron scrap.

We found that raw material containing one-fourth per cent of phosphorus was too impure to prevent brittleness in the castings, but when we mix two-thirds of scrap containing one-fourth per cent of phosphorus with one-third of refined iron, hematite, or Swedish iron, we obtain castings quite satisfactory for general purposes; when we mix half and half, we obtain castings quite as ductile as and much stronger than ordinary forgings; while using refined Yorkshire iron, hematite, or Swedish iron alone, we obtained castings which I may be allowed to call "extra" quality, that is, their ductility (as shown by the samples) probably exceeds what can be produced by forgings, while their strength is fully 20 per cent greater in all directions than the best wrought iron forgings.

All the above named mixtures, with less than one-quarter per cent of phosphorus, give us castings which can be welded and mended like wrought iron without the slightest trouble.

It seems to me that what we do might be said to be that we make exceedingly mild steel by melting the wrought iron almost free from carbon, instead of making mild steel by decarbonizing pig iron, which contains about 3 per cent of carbon.

Good pure cast iron would probably not be a much cheaper raw material than the above named mixtures of wrought iron scrap, while on the other hand we do not require the costly apparatus of the Bessemer and Siemens manufacture, and the very inconsiderable cost of our furnaces would enable our castings to be made on a much smaller scale than those made by the Bessemer and Siemens methods; while, on the other hand, those methods may produce very heavy castings more cheaply than we can. Our method will also probably be found a more economical way of using up scrap than any other.

The manner in which we make the "Mitis" wrought iron castings is as follows: You will see that the samples show an unusually clean surface, and the iron runs, perhaps, more perfectly than in the best cast iron castings. This, of course, means that we use a very great heat; in order to obtain this heat, we melt the wrought iron in crucibles placed in furnaces, each containing six crucibles. Each furnace has one fire, and we work two crucibles together; the pair furthest away from the fire is warmed to a certain degree by the waste heat, the second pair is heated also by the waste heat to a point where the scrap approaches its melting temperature, and in the pair nearest to the fire the wrought iron is completely melted. As this last pair is lifted out, the second pair is moved forward into its place, the third pair is moved forward into the place of the second, and a fresh pair of filled crucibles is placed in the compartment furthest away from the fire.

In order to obtain quickly the great heat required, we employ as fuel the residuum of petroleum, called naphtha, which is easily obtainable in unlimited quantities, and which is not in any way dangerous.

From these furnaces we can draw 8 to 10 pairs of crucibles per day of 12 hours; and when we, as we intend to do, commence working day and night shifts, we can cast 15 to 20 times every 24 hours. This is a considerable gain, as I believe that in Sheffield the crucibles are taken out only about 3 times in 12 hours; and we have the further advantage that we refill each crucible every time by its full charge of about 66 pounds of scrap, whereas in Sheffield a full charge of 60 pounds is only put into a new crucible, their second charge being about 50 pounds, their third about 45, and so on.

Our next step is to deal with this exceedingly hot iron. We have carried out a method of moulding and facing sand which works to our entire satisfaction, and we have made use of water moulds of a special construction when a great number of castings have to be made to the same pattern. In order to do this expeditiously and cheaply, we use a ladle in which we keep the iron at its full heat by means of a surface blast of very hot gases, and we fix a number of moulds around the circumference of a turntable in such a manner that one mould can be filled after the other as quickly as it is brought under the lip of the ladle, and the castings are immediately taken out of the moulds, so that each mould is ready for refilling as soon as it comes round again under the lip of the ladle.

The raw material being wrought iron only, the castings do not require to be in any way annealed, but are simply cleaned up by emery wheels or otherwise, and delivered to the purchaser.

As the iron runs so exceedingly freely without large heads, and as it falls out of the moulds so easily, this method of "Mitis wrought iron castings" must tend to save labor to a very important extent, and we have already found that it enables us to considerably lighten and greatly vary designs—such as designs of machinery, etc.—as we can, without extra cost, shape our moulds so that we give the strength of the metal where wanted, but only where wanted, whereas in forgings it would often not pay to complicate the shape.

This method also enables a constructor to make *much bolder designs*, and of more different forms, knowing that such designs can be easily and cheaply carried out. Here again we find great advantage in being able easily to *weld the castings*, as we can cast the parts, which would otherwise be difficult to forge, or which would require much machining, and weld them on to a bar or rod as required. Some of the samples show links, bearings, and clutches used in this way.

I can hardly imagine any form of forging which it would not be more advantageous to cast by this method. You see before you the most difficult forms, such as pulleys, smoke consumers, wheels, knees, and bends of piping, etc., which give the tensile strength of mild steel forgings without any greater expense than for castings of ordinary shapes, except what may be caused by the greater trouble in making the mould.

We have also lately made some very successful steel castings with a higher percentage of carbon, some samples of which, unpolished, as well as burnished, I have brought here. These promise well for the future, the surface being exceedingly clean and taking a very high polish, and we have tried them successfully for ordinary edged tools; for instance, we cast at present some of our tools for the gun factory in Stockholm, and we cast them ready to shape, after which we have only to harden and grind in order to make them ready to put into use. These steel castings we also make out of wrought iron scrap as raw material, adding the quantity of pure pig iron required to bring up the percentage of carbon to the point required for each different purpose.

I do not mean to say that tools can be made better by this method than by the ordinary methods, but it is certainly a more direct way than to make wrought iron bars into blister steel and then melt this blister steel in a crucible, and my method is certainly cheaper, seeing that pure scrap can be obtained at a very much lower figure than the bars, and that my tools are cast ready to shape.

Sciatica Relieved by Cocaine.

Dr. W. B. Menz, of Vidalia, La., writes to the *Medical Record* that he was called to see a lady, fifty-five years of age, who had been a constant sufferer from sciatica for ten years. The pain was very severe, and extended along the entire length of the nerve. She had run the whole gamut of anti-neuralgic remedies, and had never obtained anything more than very transitory relief. Having with him a vial of a four per cent solution of cocaine hydrochlorate, Dr. Menz determined to try the efficacy of a subcutaneous injection. The hypodermic needle was inserted deeply over the sciatic foramen, and about twenty drops of the solution were passed into the tissues. The pain ceased almost immediately, and during the six weeks that have since elapsed has not returned, although there has been no further treatment, and one injection only was practiced. The relief given by other remedies had never been of more than from two to four hours' duration.

IN case of a bite from a rabid dog, Dr. Billings recommends that the wounds be cauterized with strong carbolic acid. It is much less painful and more effective than burning with a hot iron. The wounds will also heal in less time.

A NEW MASS OF METEORIC IRON.

In late years the discovery of quite sizable masses of meteoric iron has been of frequent occurrence in the United States, and it has almost become unnecessary to call public attention to them, because of their great similarity.

Unless of rare form or of unusual composition, lengthy descriptions of them tend to repetition of much that has been written before.

Where these masses are seen to fall, by competent observers, all particulars concerning the time, velocity, direction, and distance are of value, and merit immediate and faithful record; especially as the data for these several particulars is very meager and not wholly satisfactory.

The mass of meteoric iron hereinafter described was not seen to fall, but was discovered in the surface soil, and thus its history is incomplete.

Of the 130 or more known masses of meteoric iron, only about half a dozen were seen to fall, all the others being accidentally discovered in a manner similar to the one here noticed. Of the stony meteorites in the collections, perhaps of all of them the exact date and hour of fall is known or closely approximated.

Of a necessity these wanderers in space make no choice of locality when they come down to us. As many may be discovered in one place as in another; we know of no law prescribing the latitudes wherein they must arbitrarily fall.

Attention is called to this because the writer has lately seen, in a foreign publication, a map of the world on which were indicated the localities where meteoric bodies had fallen, and it was evident that the majority of these discoveries were in regions of the earth's surface *most densely populated*.

For instance, on the continent of North America, the region between the 20th and 44th parallels east of the Mississippi River monopolized the great majority of these occurrences; while in Europe the same statement would apply west of the Urals, between the 44th and 60th parallels; and in India, between the 10th and 30th; while the great domains of Siberia, Africa, Australia, South America, British America, and Alaska present (according to the records) only a few scattering discoveries of this character.

All this shows to us that these regions of the United States, Europe, and of India, which have been so prolific, are only indicators of the immense number of these celestial bodies which have fallen to the earth, and *which must be* ultimately discovered in the as yet *almost unknown* areas as they become peopled.

China, with her dense population and immense area, has kept within her borders all specimens and all data relating to her meteorites, and, reasoning from analogy, a very goodly number must exist there. Altogether only about 400 distinct finds of meteorites (stony and metallic) are recorded, which number is certainly not very great when we consider it covers all historic time.

We now pass to the consideration of the lately discovered mass of meteoric iron in Arkansas.

This mass was found in the latter part of June, 1884, in the manner set forth in the communication from Mr. John Hindman, surveyor and civil engineer, of Elmo, Ark. He writes under date of July 2, 1885, as follows:

"As to the history of the meteoric specimen: It was found about the last of June, 1884. My stepson, George Whitfield Price, accompanied by my son, John W. Hindman, and a young boy by the name of Monroe Marshall, concluded to take a ramble through the woods. They went along the north side of White River, to a mountain known as the 'Joe Wright Mountain.' This small eminence is situated about six miles below Batesville, Independence Co., Ark. The boys wended their way to a spur of the mountain running northwest, densely overgrown with cedar and pine. The soil there was underlain with a kind of shale, into which time had made many inroads in the way of deep gullies. As these gullies led down the mountain side they converged into one. It was where these gullies met that my stepson found the meteor. It had undoubtedly been embedded a short depth below the surface, and as the earth washed away it became exposed and dropped to the bottom of the gully at the place where it was found. The boys rigged up a 'drag' of poles and bark, and brought it home, where it remained until we took it to Newport, Ark., to be sent to the New Orleans Exposition."

It was at the World's Industrial and Cotton Centennial Exposition that this mass of meteoric iron first came to the writer's notice. It formed a part of the very attractive mineral exhibit of the Arkansas section. It remained there until June, 1885, when it came into the possession of the writer and was sent to Newark, N. J.

By referring to the engraving (Fig. 1), the reader will get a correct idea of the exterior appearance of this celestial visitor. Its surface is pitted with ovoid depressions, which lie with their longer axis in nearly the same general direction, this direction being parallel to one set of the Widmanstatten lines.

The surface was almost black in color, and looked blistered. No rusty appearance or alteration from oxidation was noticed on any part of the mass, which would go to prove that this meteorite had not long been on the earth.

Its weight is ninety-four pounds. It is seventeen inches long, and eight inches thick in its greatest diameter.

While in point of size it is unusual, yet several masses lately described excel it in this respect, notably the mass from New Mexico and the "cigar-shaped" mass from Tennessee. This Arkansas mass has a very large surface compared to its weight, on account of being thin on its edges and of the many hollow depressions.

Fig. 2.—NATURAL SIZE OF THE WIDMANSTATTEN LINES ON THE INDEPENDENCE CO., ARK., METEORIC IRON.

Its most interesting feature is the presence of a *hole* through its edge measuring five-eighths inch in its smallest diameter. (The situation of this hole is shown in the engraving by a ribbon tied through it; see Fig. 1.)

The length of the aperture is one and three-quarter inches and is cone-shaped from both sides, being smallest in the middle. This very remarkable feature is almost without a parallel among meteorites. It reminds us of the famous natural ring of meteoric iron in the Smithsonian Institution, that weighs more than half a ton; the aperture being large enough for a man to crawl through.

The small surface which in Fig. 1 shows faintly the characteristic Widmanstatten lines is better illustrated in Fig. 2, which is of *exact natural size*, and was taken direct from the meteorite by the Ives photo-engraving process.

Probably no better representation of the Widmanstatten lines—one having the *natural* appearance—has been published heretofore. The use of the iron itself to print from is wrong, for surface printing, since it gives in the impression dark lines for white lines. If a section was properly prepared for use, after the manner of copper-plate printing, results quite as good as this new process gives might be obtained.

Fig. 1.—THE INDEPENDENCE COUNTY, ARK., METEORIC IRON.—ONE-THIRD NATURAL SIZE.

The Widmanstatten lines in this iron are remarkably perfect and abundant. Their apparent tendency to produce right angles is a rather uncommon feature.

Troillite (Fe.S) was noticed on the polished face as thin seams, having a bronze luster, which penetrated deeply into the mass.

An analysis of the main mass of the meteorite by James B. Mackintosh, E.M., gave 91·22 per cent of iron, 0·16 per cent phosphorus, and 8·62 per cent (by difference) of nickel and cobalt, nothing unusual thus appearing in its composition.

WM. EARL HIDDEN.

N. B.—If any of our readers should know of the existence of masses similar in nature to the above, they will confer a favor by notifying the SCIENTIFIC AMERICAN office. Should any meteorites fall in their vicinity, or within their knowledge, we would be glad to receive early information of them, and also samples of the fall.

The Times We Live In.

On all hands the cause of the recent stagnation in trade is assigned, by business men, to overproduction. It has been said that overproduction means simply the clogging of the markets by too much wealth. It is meant that there is too much wheat, too much corn, too much iron, too much coal, too much cotton, too much of the great staples of wealth generally, preventing those who complain from getting as much for what they have for sale as they expected to get, or to sell as much to others as they expected to sell, or to make prices fluctuate in a manner profitable to modern speculation. In short, such an abundance of any of the staples that speculators cannot create a corner in the market, and thereby oppress the poor laborers in the interests of questionable methods, to say the least, in speculation.

If we look over the world, we will find that there never was a time in the history of the race when the luxuries of life were so widely disseminated and enjoyed by so large a portion of the commonalty of mankind as now. The ability to afford the luxuries and pleasures of life is increasing very rapidly among the working classes, and most rapidly among the most industrious and hardest working classes.

It has been pertinently remarked that "putting aside the wealthy classes, there never was a time in which more people could wear silk and broadcloth, have vacations, take journeys, eat ice cream, provide pianos and organs for their families, go to the races, the theater, and the polo ground," than at the present time. And it is safe to say that, as a rule, these classes take advantage of the opportunities offered. It is also equally true that there is a great deal of extreme poverty existing throughout the country in connection with crime and ignorance and indolence in many places and employments; but this is the exception to the general rule of widespread prosperity in the middle and lower classes of humanity generally.

That there is a general tendency all over the world to an increase in the production of the luxuries and common comforts of life cannot be doubted; and if this overproduction is an evil, it is unmistakably an increasing evil. This is necessarily the case. The constant progress made in the invention and manufacture of labor saving processes, the increase of the productiveness of labor, with increasing intelligence, cannot result otherwise than in an increase in the surplus production. This may in one sense be an evil, but it certainly is not an evil when you regard it in the light of the comfort and progress of the race; for whatever increases the facilities for making home more comfortable and attractive increases the pleasures of home and home life, ennobles work, and makes the ties to government and an upright living tenfold stronger. It will also tend to shorten the hours of labor and increase those of recreation and pleasure. This cannot be regarded as an evil by any save those who regard a laboring man as simply a drudge, and his every hour of recreation and pleasure, above those actually required for sleep, as so much precious time wasted.—*Jas. M. Kerr, in Chicago Current.*

Car Builders' Association.

The committee appointed by the Master Car Builders' Association and several representatives of brake companies met at Harrisburg, Pa., on Jan. 6, to devise a plan for the testing of the brakes now in use. It was decided to have two tests at Burlington, Iowa, on the Chicago, Burlington & Quincy Railroad. The first trial is to be on July 13 next, and the second on the 13th of April following. Each brake company is to furnish fifty cars fully equipped with its apparatus.

The cars are to be returned to their owners and put in actual service between the times of the tests. On their return, a careful record of the cost of maintenance and the number of miles traveled is to be submitted to the committee. At the final test, a year from next April, the brake which is decided to be the most effective is to be adopted as the standard, and recommended for adoption by the different railroad companies in the United States.

ENGINEERING INVENTIONS.

An operating mechanism for railway switches has been patented by Mr. William B. S. Reed, of Brooklyn, N. Y. This invention provides a mechanism whereby but a single lever is used, and such lever is inoperative to open more than one switch or system at a time, or to open another while one remains open.

AGRICULTURAL INVENTIONS.

A hand corn planter has been patented by Mr. Seth Hackett, of Bronson, Mich. It has a combination of pocketed disks, which are intermittently rotated to effect the discharge of the seed and secure a reliable delivery every time the planter is operated or moved stepwise to the operator.

MISCELLANEOUS INVENTIONS.

An automatic flushing siphon has been patented by Mr. William B. Parsons, Jr., of New York city. This invention covers a main and auxiliary siphon of novel construction for intermittent flushing, in connection with a water closet or for other similar purpose.

A carpet stretcher has been patented by Mr. Robert R. Jones, of Blossburg, Pa. It consists in a bar having at one end a spur to be driven into the floor, and having pulleys, a lever, and a rope, while combined therewith is a sliding crosshead carrying pointed teeth or hooks for engaging the carpet.

A twine and wire cutter has been patented by Mr. William L. Haas, of Charles City, Iowa. It has a handle section with hollow head in which is fulcrumed an upper lever section with cutting edge and movable jaw, with other novel features, making a tool to cut telegraph wires or the wires or twine bands used for binding sheaves of wheat, etc.

A draught equalizer has been patented by Mr. John L. Powles, of Goodland, Ind. The single and double trees are so pivoted as balanced levers that the draught will be made alike for four horses working abreast, with one horse at one side of the tongue and three horses at the other side, which is often desirable in operating grain harvesters and other machines.

A bag holder has been patented by Mr. Walter S. Kendall, of Grand Rapids, O. This invention relates to a device for holding bags open and in an upright position to be filled, facilitating the attachment of the empty bags to the holder and their removal therefrom, and preventing the spilling of substances over the mouth of the bag.

A windlass has been patented by Mr. Frederick W. Thomson, of Maitland, N. S., Canada. This invention covers a novel arrangement of friction band wheels and bands, with a contrivance of break mechanism comprising brake shoes which may be forced against the interior faces of flanges on the main grabs or purchase wheels.

A magazine spring gun has been patented by Mr. Stephen D. Engle, of Hazleton, Pa. It has a longitudinally slotted barrel with a follower fitted to work therein, subject to the control of the trigger, with other novel features, the invention being an improvement on a former patented invention of the same inventor.

A wood sawing machine has been patented by Mr. Samuel P. Dresser, of Pleasant Mount, Mo. It can be operated by one or two persons, by turning one or two cranks, whereby a saw is rapidly reciprocated, the saw blade being pressed downward in the kerf by a spring, the pressure of which can be readily regulated.

An umbrella or parasol has been patented by Mr. George W. Jones, of Brooklyn, N. Y. It has telescopic braces and a runner connected with the ribs, the braces and their runner, in connection with a hollow stick, to hold the ribs from being forced too far back, with other novel features, to promote convenience in opening and closing umbrellas and parasols.

A barrel making machine has been patented by Mr. Josiah J. Philbrick, of Birmingham, Ala. It is designed to allow more effective trussing of the staves and hold them even across the edge joints on both faces, keeping the croze of the staves even or in line all around the barrel or cask, so the heads will fill the croze and make a perfectly tight barrel or cask.

A pipe vise has been patented by Mr. Andrew L. Rose, of West Troy, N. Y. This invention provides for vises constructed to hold pipes firmly while being cut, or having screw threads cut in them, and the vise can be readily adjusted to hold pipes of different sizes, and conveniently operated to clamp and release pipes.

A saw has been patented by Mr. George N. Clemson, of Middletown, N. Y. It has its opposite edges hardened, with a soft body between the edges, making a cutting edge which is very hard and durable, and at the same time furnishing a saw which is tough and flexible, and especially adapted for use by butchers, metal workers, etc.

A device for centering vessels in dry docks has been patented by Mr. Adam Bulman, of Jersey City, N. J. This invention consists principally of an attachment made with two sliding blocks adapted to engage with the opposite sides of the keel of a vessel, and to be moved to the center of the dock by drawing upon ropes attached to the sliding blocks.

A funnel has been patented by Mr. Frederick Catlin, of New York city. It has a cock casing formed with longitudinal and transverse apertures, with other novel features, and is adapted for use not only for pouring liquid from one vessel into another, but also for measuring and conveying or transporting liquids.

The producing of metallic printing plates has been patented by Mr. Cesar Felix Josz, of Bockenheim, Germany. The process consists in first mechanically graining the plates, then extracting all grease by alkalies, and opening or raising the grains by means of astringents operating mechanically, and giving the metallic surface the affinity for ink, lithographic crayon, etc.

A hose or suction tubing forms the subject of a patent issued to Mr. James Jones, of Dublin, Ireland. It is formed of fabric treated with oil to render it air and liquid proof, the fabric being wound on a spiral wire core and held in place by a spiral wire wound around it, the metallic support for the tube proper being intended to prevent any considerable contraction under suction.

A folding box or crate has been patented by Mr. Edward Harris, of Cambria, Wis. The ends are hinged to end pieces and the sides to side pieces of the base section, while on the inner surfaces of the ends are held wires which extend from top to bottom, the lower ends forming hooks projecting from each other and the upper ends being bent over the top edges, the wires being held in place by staples.

A ventilator has been patented by Mr. Richard de Logerot, of New York city. It consists of an elastic bulb with valves and tubes, one tube leading outward and the other connecting with perforated distributing pipes in an apartment, the bulb being operated by clockwork mechanism to alternately compress and permit the expansion of the bulb, for ventilating buildings, public conveyances, mines, etc.

A clothes drier has been patented by Messrs. Charles Goodyer and William Morse, of Warren, Pa. It consists in a hollow upright having offsets in the sides, the offsets having openings, with a slide in the upright, and arms or bars pivoted to the side edges and projecting through, making a clothes bar of simple construction, which can be compactly folded when not in use.

NEW BOOKS AND PUBLICATIONS.

POULTRY CULTURE. How to Raise Manage, Mate, and Judge Thoroughbred Fowls. By I. K. Felch. Chicago: W. H. Harrison, Jr., 1886.

Poultry culture has heretofore received from the farmer just as much attention as he regarded necessary to keep the flock alive, after everything else on the farm had been looked after. Now, however, the introduction of business methods into farm work has caused an invasion of the poultry yard also. Enthusiastic exponents like Mr. Felch have brought forward an array of results that is quite astonishing. Few people realize the fact that the egg and poultry product of the United States exceeds in value such substantial crops as corn, cotton, or hay, and that the profit, in keeping some of the finer breeds of fowl, amounts to as much as $4.00 per head. When these are remembered, the industry seems worthy of careful attention, and one can understand why Mr. Felch should recommend it to young men as a possible opening. In presenting the results of his own thirty years' experience in the business, he is able to give a great many valuable hints to those similarly interested.

Art Age, published monthly, $2 a year. Turnure & Gilliss Bros., 75 Fulton Street, N. Y. This contains usually one or more supplements—reproductions of paintings, decorative designs, photographs, architectural drawings, etc., specimens sometimes of several different engraving processes. The January number is particularly attractive.

Business and Personal.

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Order our elegant Keyless Locks for your fine doors. Circular free. Lexington Mfg. Co., Lexington, Ky.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

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Wood Working Machinery. Full line. Williamsport Machine Co., "Limited," 110 W. 3d St., Williamsport, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 45.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

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Curtis Pressure Regulator and Steam Trap. See p. 350.

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Wanted.—Second hand Engine and Boiler, about 8 horse power, to drive yacht. Must be in good condition Send price and description to Jos. Minchener, Lane Park, Fla.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) A. W. C. asks: Will the attachment of the ground wire from telegraph office to a water pipe effect the freezing of the water? A. No. The freezing must be due to the position of the pipe, and not to the effect of the electric current.

(2) M. L., Jr., writes: A fire alarm telegraph wire goes over the house I am in. It is held in place by a glass insulator at the ridge of the roof. Now, I have an electric bell, such as are used for door calls, etc., which I would like to connect with this fire alarm wire if I can without cutting it. A. By connecting the wire with the fire telegraph wire, running it to your bell, and from the bell to a good ground, you will be able to get the alarm; but we think you would render yourself liable by such an operation, and might also interfere with the efficiency of the fire alarm telegraph.

(3) E. A. C. writes: I wish to make an electric motor one-half the size of the one described in SUPPLEMENT, No. 161, and I am uncertain about the size wire which should be employed in winding the field magnet and armature. Can you inform me through the SCIENTIFIC AMERICAN? I also wish to know how many layers of wire should be wound on the field magnet, and how many Robert's batteries (e. m. f. 2 volts) would be necessary to run the same? A. For a motor, you should use No. 16 wire on the armature, and the same size on the magnet, employing about four layers on each leg of the magnet. You would require 5 or 6 cells of the battery. 2. What form of motor is best for running a small fan, and where can I get drawings or information in regard to the same? A. Probably there is no better form for a small motor than the one you propose to adopt. 3. I wish to make a spark coil for electric gas lighting, and do not know the size wire which should be employed, or the number of layers which should be wound around the core, in order to secure the best results. A. SUPPLEMENT, No. 160, will give you information that will enable you make a coil for *lighting* gas.

(4) W. K. asks: What substance could I add to wax (such as used for artificial flowers), in order to render it pliable in cold weather and at the same time preserve its whiteness? A. Any substance which would render wax pliable in cold weather would render it too soft to preserve its shape in warm weather. Paraffine is sometimes added to wax to toughen it. A small percentage of glycerine might also effect the same result.

(5) J. McC., Jr., writes: I am making a dynamo-electric machine like one described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, with permanent magnets. 1. Does increased speed give increased power, or is there a limit to the speed which gives the best results, and if so, what is it? (I use twelve 1 inch magnets, and armature is 3¾ inches long.) A. Increased speed gives increased power; the limit of speed is governed by the rapidity of magnetization and demagnetization of the core of the armature. 2. Is this machine able to drive a small incandescent light, and how many candle power? A. This machine will drive three or four 4 candle power lamps. 3. Will it be improved for running an incandescent light by using finer wire on the armature, and what number of wire? A. For a single lamp of high resistance, yes. 4. Will a dynamo driving an incandescent lamp (say four candle power) be able to drive four one candle power lamps? I have noticed that one candle power light requires more than one-fourth the number of volts that a four candle power lamp requires. A. It depends, of course, upon the resistance of the lamps and the way in which they are arranged in the circuit. We think, however, that you could drive four one-candle power lamps with a machine that would supply a four-candle power lamp.

(6) J. O.—Propeller wheels are named from their form of the section of a screw, and plow through the water in the same manner that any screw runs in a nut, only that the pitch is greater and the nut is water.

(7) C. & D.—Diamond drills are made by setting borts or black diamonds in the ends of iron or steel tubes. The tubes are rotated, cutting a solid core, which, by an arrangement of a nipper in the drill, is lifted out with the drill.

(8) W. A. B.—There are several reckonings of time. The civil year commences at midnight, December 31. The astronomical year is also reckoned with the civil year. The equinoctial year is reckoned from the vernal equinox. The sidereal year is the time of revolution of the earth in its orbit from a given line between the sun and a fixed star. The perigee is not used in the division of time, only in regard to the moon. Perihelion is the earth's position when nearest the sun.

(9) J. L. asks (1) how Fehling's solution is made. A. Fehling's solution is made by dissolving 34·63½ grms. pure copper sulphate in water and adding a solution of 173 grammes of Rochelle salts in 480 cubic centimeters of sodium hydrate having a density of 1·14 and diluting to one liter. 2. How to detect putty

powder in other mixtures used in polishing plate. A. We know of no means except by chemical analysis. Some of the ordinary tests for tin might be applied. 3. Can good brandy be made from sour, musty wine? A. Brandy can be obtained from the wine designated by distillation. As to the quality, we cannot say. 4. Does the law allow a man having a still for chemical purposes to distill enough liquor for his own use? A. It is necessary to have a license in order to distill liquor, whether for private consumption or public sale. 5. What is good to varnish scraps in a scrap book, something that will not stick the leaves together? A. Boil clear parchment cuttings in water in a clean glazed pipkin till they produce a very clear size. Strain it and keep it for use.

(10) D. B. asks how the chilled mandrel is made to cast cast-iron box for wagon axle so he will not have to ream them. A. Make the chill mandrel of wrought iron of the proper taper, and make a slot ⅛ inch wide its entire length and nearly through; fill the slot lightly rammed with moulding sand or weak core sand. If this does not spring enough to prevent the box from cracking by shrinkage, cut the slot wider or bore a hole clear through the mandrel.

(11) D. W. G. desires the formula of Dr. Tebbett's Physiological Hair Regenerator. A. This preparation is an aqueous solution of acetate containing about 6¾ grains of metallic lead to each ounce of the fluid.

(12) G. F. N. asks whether salicylic acid will preserve animal and vegetable oils, and what effect the acid has upon the human flesh or skin. A. See the article on salicylic acid contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 220. This acid prevents fermentation and putrefaction. The dry powder of the acid has practically no effect upon the skin, *i. e.*, it is not corrosive.

(13) J. H. E. asks (1) how to color kerosene different shades, what, and how to use it. A. Use aniline colors sold as soluble in oil. 2. How to nickel plate? A. See the article on "Electro Metallurgy" contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 310. 3. How to fasten a lamp chimney to a revolving head for cleaning? A. It can be clamped on to a wooden chuck, but the head should be specially adapted for such use.

(14) C. J. M. asks if there is any way of taking out stains from matting or carpet, caused by dripping from stove pipe. A. The dripping probably consists of so many ingredients that its removal cannot be accomplished. Soot, for instance, cannot be removed. If it is simply coal tar, try water and then alcohol.

(15) J. W. P. asks how to make a paste for placing labels on tin and glass. A. See "Reliable Paste for Labels for Glass, Wood, and Metals," page 199, SCIENTIFIC AMERICAN for September 26, 1885.

(16) A. B. asks: What is the process used for covering pills with a white stratum (not sugar *coated) that will be* damp proof? A. They are *probably gelatine* coated, *i. e.*, covered with a strong solution of 6 parts of gelatine and 1 part sugar. See "How to Coat Pills with Gelatine," SCIENTIFIC AMERICAN SUPPLEMENT, No. 370.

(17) G. E. B. writes from Hillsboro, Dakota: At a depth of 126 feet, in drilling an artesian well, a vein of gas was struck, which threw at once all water out of 2 inch pipe to a height of 30 feet. Applying a torch, the flame shot up ten feet, burning with great brilliancy and intense heat until extinguished. Would such a vein, if continuous, be of utility for illuminating or other purposes? A. Yes. Natural gas is now extensively used for illuminating purposes and also as a substitute for coal and wood in producing heat.

(18) H. E. D. asks why trichinæ do not kill the animal. A. The trichinæ will kill the animal if they are allowed to develop sufficiently, but the animal is generally slaughtered before the parasites mature sufficiently to produce death.

(19) K. asks if it is possible to get zinc or tin in finely divided state, by any chemical means, from their salts, same as we reduce copper from the sulphate. A. Zinc dust is a commercial article, and is obtained in the manufacture of the metal. Fine crystals of tin can be obtained when water containing zinc dust in suspension is gradually added to a solution of tin chloride. There is no practical chemical process that we can recommend.

(20) J. A. asks how to make the best spirit varnish suitable for varnishing carved wood. A. A shellac varnish will answer, made by dissolving shellac in 95 per cent alcohol. The color of the wood will influence the selection of the gum. Spons' Workshop Receipts, 1st Series, which we can send for $2, will give you a number of valuable formulas that may be used.

(21) A. M. asks (1) how to prevent rubber boots from cracking. A. Rubber boots are coated with a flexible varnish in the course of their manufacture. The application of a solution of rubber on carbon disulphide may be of some help, but it would not be permanent. 2. How to prevent rain coming in a skylight. A. Tight joints will prevent the entrance of rain; we know of no other means.

(22) G. H. D. desires a receipt for making compressed yeast such as is sold in little flat squares, about an inch square, covered with tin foil. A. This yeast is obtained by straining the common yeast in breweries and distilleries until a moist mass is obtained, which is then placed in hair bags and the rest of the water pressed out until the mass is nearly dry. It is then sewed up into bags for transportation.

(23) T. R. W. asks how to make a preparation to paint iron cores with, so that they will slip out of the castings easily and leave a perfectly smooth hole. A. Paint the cores with black lead, ground fine, and water. When nearly dry, smooth the surface with a trowel or slicker.

(24) J. G. W. asks for some process of hardening crude petroleum. He wants to make an axle grease similar to the common axle grease in the market. A. Use paraffine or tallow. See the article on "Lubricants," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 316. A number of valuable receipts are given in the paper referred to.

(25) S. L. asks the use and value of bat guano. A. It is used as a fertilizer. Its commercial value is dependent upon its analysis. 20 cents is the market value per unit of bone phosphate contained in the guano, and $1.75 is the value of nitrogen equivalent to ammonia. These prices are by the ton. Ordinary bat guano seldom contains two per cent of nitrogen equivalent to ammonia, although from 4 to 5 per cent are sometimes found.

(26) N. L. B. asks: Can the glue in old water color be removed by any simple and cheap process? If so, how? That is, so the pigments may be used again by the addition of fresh glue. A. By soaking the material in water till it becomes disintegrated, then adding fresh water and continuing to do so, in time all of the glue will be washed out, leaving the pigment behind.

(27) B. C. H. asks: 1. In qualitative analysis, an easy way to separate iron and zinc, both being precipitated by ammonia. A. Zinc is not precipitated by ammonia, therefore filter and test filtrate with hydrogen sulphide for zinc. 2. Of what does the purple solution in the porous cup of a chrome battery consist, and does it clog up the pores at all? A. Probably chrome alum. It crystallizes, and so clogs the battery.

(28) A. S. G. asks if hydrogen peroxide is one article and Naquet's bismuthic dye another, or do they both mean the same thing? A. They are two independent and separate articles. The bismuth dye referred to is not made commercially in this country, as far as we know. The hydrogen peroxide can be purchased from any wholesale druggist in New York or other commercial center.

(29) C. E. Q.—Cherry stain can be removed by using a strong solution of oxalic acid, but you will find it preferable to stain it a darker color, by using some of the liquids recommended for walnut stains.

(30) F. T. asks if there is any receipt for making a pomade for polishing metal that is superior to the German metal putz polishing pomade. A. In answer to query 20, in SCIENTIFIC AMERICAN of May 2, 1885, a formula for a paste is given which is cheaper and equally as efficient as the putz pomade.

(31) G. F. D. asks: What gives beef oil a rye bread taste, or what acid is used to flavor beef oil for butterine purposes? A. Probably butyric acid. See the "Manufacture of Artificial Butter," contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 48 and 49, also Dr. Tidy's article on Butterine Manufacture, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 397.

(32) A. J. W. asks: Is the bite of the skunk sure hydrophobia, or is there anything known about it? A. The skunk is often affected by a disease which renders its saliva so poisonous that its bite is more to be feared than that of the rattlesnake. Many instances are given in which persons sleeping on the ground have been bitten, generally with fatal, and always with dangerous, consequences. It has not been shown, as far as we know, that this disease has any connection with hydrophobia.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

W. H. F.—The amount of alumina contained in sample of clay can only be determined by analysis, the expense of which would be $12.00. All clays contain alumina, but no economical process of extracting the metal is as yet known.—J. M. M.—Your own description of the minerals is quite correct; they appear to be varieties of decomposed silicates, such as feldspar and mica. The specimens were examined for tin, but none was found. We would suggest that a larger quantity of the suspected tin ore be sent to us, with $5.00, to pay for an assay, which would definitely settle the subject.

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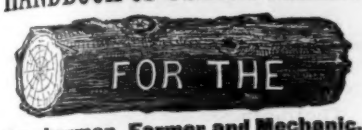

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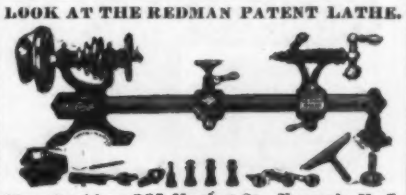

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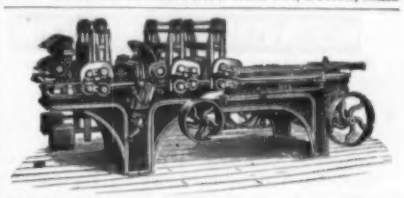

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